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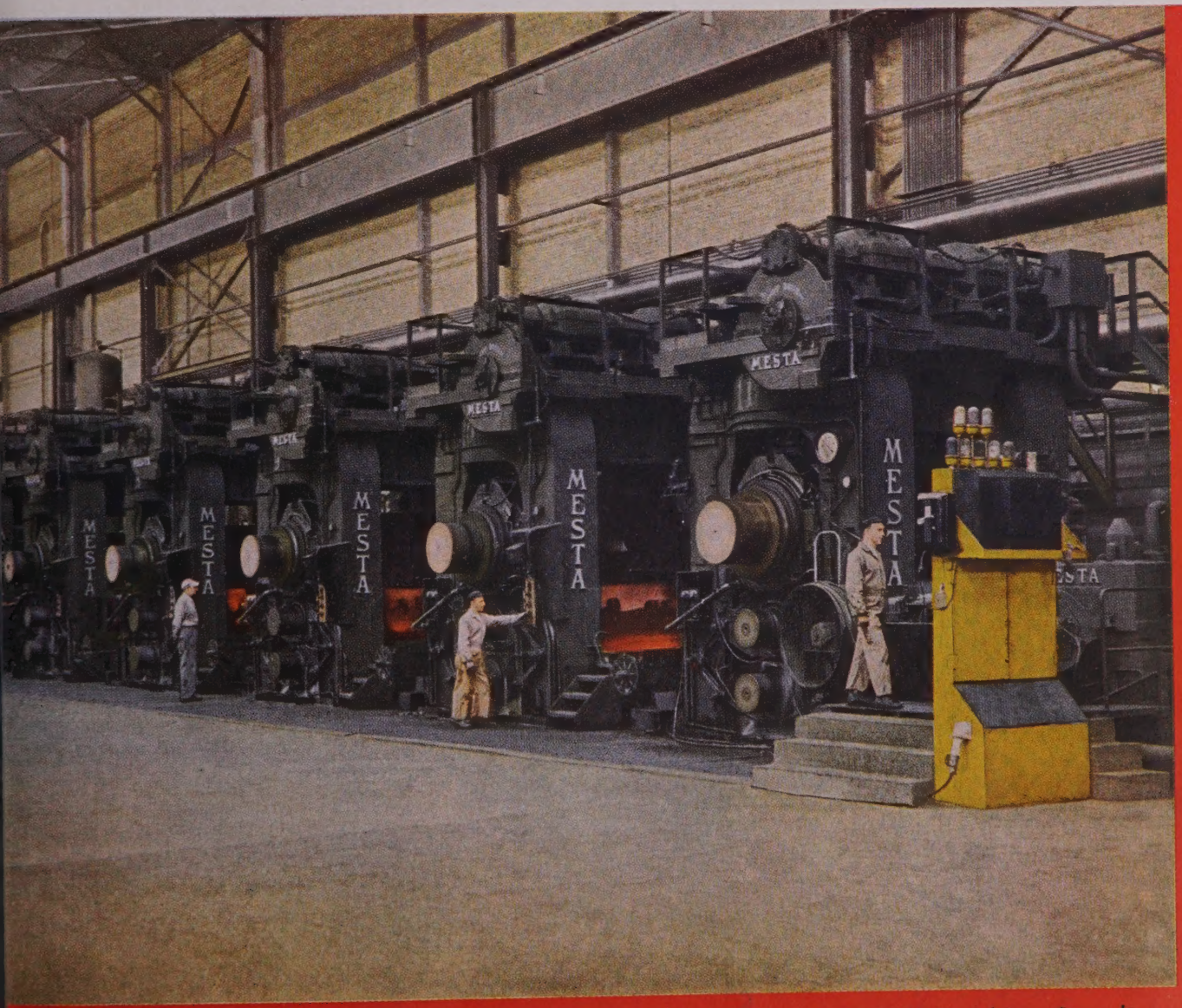
The
IRON AGE

JANUARY 6, 1949



OR PHOTO BY E. D. MESTA

Mesta 68" Four-High Continuous Hot Strip Mill Finishing Stands

HOT STRIP MILLS
. . . designed and built by

MESTA

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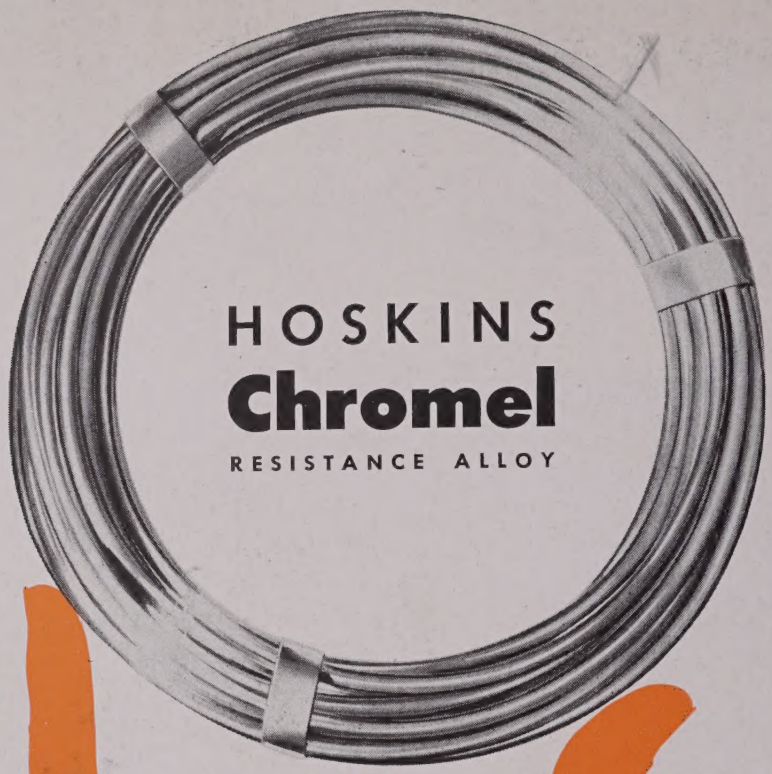
DESIGNERS AND BUILDERS OF COMPLETE STEEL PLANTS

MESTA MACHINE COMPANY · PITTSBURGH, PA.



. . . basic element of electrical heating

If you're concerned with electrical heating . . . either in your products or in your manufacturing process . . . you have a lot in common with Hoskins CHROMEL resistance alloy. For CHROMEL, you know, is the *original* nickel-chromium alloy that first made electrical heating practical. It's durable . . . gives good, dependable service over years of hard, hot use. It possesses close-to-constant "hot" resistance between 700° and 2000° F. Delivers full rated power throughout its long and useful life. Permits even distribution of heat and accurate control over temperatures. Gives clean, quiet, fumeless heat when and where you want it. And CHROMEL is produced as wire, ribbon or rod to meet the requirements of a wide range of electrical heating applications. Catalog-M¹ tells the complete technical story . . . want a copy?

HOSKINS MANUFACTURING COMPANY
4445 LAWTON AVE. • DETROIT 8, MICHIGAN

Heating Element Alloys ★ Heat Resistant Alloys ★ Thermocouple Alloys ★ Spark Plug Electrode Wire ★ Special Alloys of Nickel ★ Electric Heat Treating and Laboratory Furnaces

Chromel
nickel-chromium wire

THE IRON AGE, published every Thursday by the *CHILTON CO. (INC.)*, Chestnut and 56th Sts., Philadelphia 39, Pa. Entered as second class matt Nov. 8, 1932, at the Post Office at Philadelphia under act of March 3, 1879. $8 yearly in United States, its territories and Canada; other Weste Hemisphere Countries $15; other Foreign Countries $25 per year. Single Copies 35¢. Annual Review Number, $2.00. Vol. 163, No. 1.

ATKINS

Silver Steel BLADES

MORE CUTS PER BLADE

LOWER COST PER CUT

Atkins "Silver Steel" Blades in your hacksaw machines mean faster metal cutting at lower cost. Because of famous Atkins "Silver Steel", these blades hold their extra-keen, extra-tough tooth edge longer. How this pays off in more cuts per blade, lower cost per cut and less time lost in blade changing, is illustrated in the reports at right. Ask your distributor to have an Atkins Cutting Engineer arrange an actual demonstration on work of your own choice.

And for a similar saving on all metal cutting done by hand, tell your distributor you want Atkins Silver Steel "Blue End" Hand Blades. They're the easiest and fastest cutting hand hacksaw blades you can use.

Check THESE TYPICAL CUTTING REPORTS

✓ **160 CUTS**
Atkins "Silver Steel" Blade made 160 cuts through 6" diam. S.A.E. X1335 (approximately 4512 sq. ins.) Blade still good.

✓ **4270 SQUARE INCHES**
After cutting 4270 sq. ins. of S.A.E. X1335 Atkins Blade still good for more.

✓ **32 CUTS**
Atkins Blade made 32 cuts through 4" dia. stainless steel (Type No. 303) at average 12" per cut.

✓ **610 CUTS**
After 610 cuts on 3" S.A.E. X1335 Atkins Blade in good condition.

✓ **165 CUTS**
After 165 cuts through 6" diam. S.A.E. X1335 Atkins Blade in good condition.

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"ATKINS ALWAYS AHEAD"

MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB

Power and Hand Blades • Milling Saws • Slitting Saws • Segmental Cold Saws • Metal Cutting Bands

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COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared Each Month by Bridgeport Brass Co. "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE and COPPER*

Metal Fabricating Outlook for 1949

Offsetting Higher Manufacturing Costs

What metal problems will confront users of copper and brass mill products in 1949? What will be the effects of high labor costs, tightness of supplies and high prices of raw materials? Answers to some of these questions can probably be drawn from our experiences during 1948.

In an effort to maintain prices of fabricated items, in spite of rising labor costs, raw materials and supplies, fabricators are making a careful study of the many factors involved and have taken one or more of the following steps where possible:

1. Cutting down the number of operations.
2. Reducing finishing costs; extra operations; bad work.
3. Increasing operating speeds.
4. Changing type of operations to reduce finishing costs.
5. Installing more modern, labor-saving equipment.
6. Better work flow and materials handling.
7. Redesigning of product for greater simplification.
8. Reducing maintenance through better materials.

Cutting Down Number of Operations

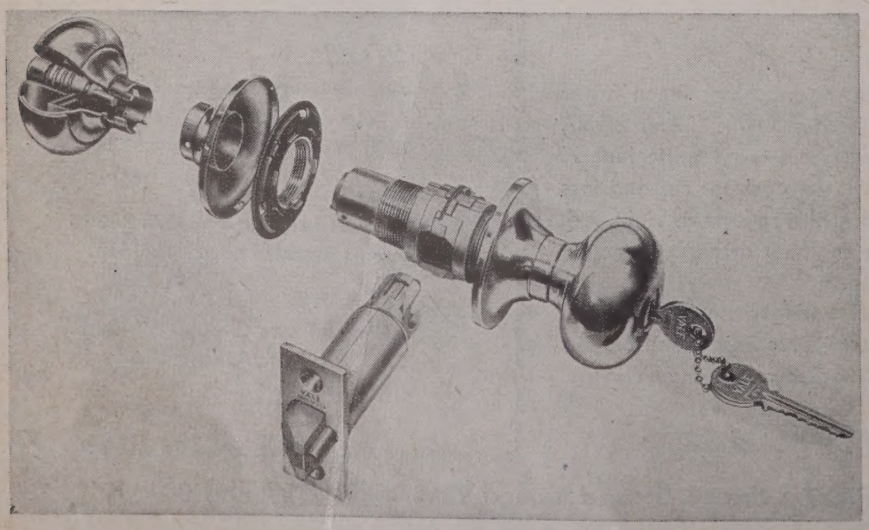
Because brass and other copper-base alloys are much more ductile than those made years ago, it is often possible to increase the severity of drawing operations between anneals, thereby cutting down the number of operations.

Reducing Polishing Costs and Spoiled Work

More attention is paid to finishing costs which involve a large percentage of labor. Careful control of annealing to produce small grain sizes and smoother metal cuts down polishing time. Much can also be done through more careful handling of both raw materials and the product itself during various stages of manufacture. Dents and scratches are expensive to remove and add much to costs and spoilage. Avoidance of tote boxes by battery grouping of operations, specially-designed trays for keeping polished work from denting, good housekeeping, respect for clean, fine surfaces all are helpful measures. Constant watching of excessive scrap and frequent analyses of costs involving expensive "extra operations" bring in unexpected dividends.

Cutting Costs and Improving Quality Through Redesign of Product

Redesign has played an important part in the builders' hardware field to bring down both cost of manufacture and installation by the consumer. For example, large, heavy front door locks with cast brass handles and escutcheon plates are rapidly being replaced by a smaller, lighter but much more efficient product. Door knobs and escutcheons are made from sheet brass by stamping or forming. The new locks are also more ingenious. The lock body is cylindrical in shape, requiring only two drilled holes in the door for rapid and inexpensive installation. Compare this to the old fashioned front door lock, which requires a large mortise by a skilled carpenter. The cost of installation was often higher than the price of the lock itself! Redesign of the product is, of course, helping other industries to increase sales appeal and often to reduce cost of manufacture.



Redesigned for modern styling and economical installation, the new Yale heavy-duty tubular lock is packed in pre-installation units. Double thickness of strip brass in the door knob prevents denting. Streamlined wrought brass escutcheons have replaced castings. Courtesy Yale & Towne Manufacturing Company, Stamford, Connecticut.

Increasing Operating Speeds

Many manufacturers have succeeded in speeding up their machining operations by changing to a free-machinable alloy. For example, the use of leaded Naval Brass instead of regular non-leaded Naval may double machinability without greatly affecting the strength or corrosion-resistant properties. Longer tool life and faster cutting speeds for tough alloys can often be attained by using the correct tool shape, a change to carbide or other harder tool materials, or by using the proper lubricants or coolants, which quickly draw away the heat generated by the cutting operation. Our laboratory has helped customers greatly in this respect.

Change in Operations to Reduce Finishing Costs

Change in methods of fabrication of the product may bring appreciable economies. One manufacturer, tired of the excessive cost of polishing rough sand castings of brass, redesigned the part by using a number of screw machine parts made from free-turning brass rod, which could be polished on automatic equipment. Another evolved a method of making a part from tubing by cold forging without changing the physical appearance of the finished part appreciably. This item had been made from sand cast brass for many years.

Changes from castings to hot and cold forgings have also taken place. Aside from lower finishing costs, a better article is often made from wrought metal as against a casting, doing away with the problem of poor castings, porosity, and rough surfaces.

Better Work Flow and Materials Handling

Rearrangement of machines and equipment to eliminate awkward handling; integrating departments to avoid unnecessary transportation from one room to another; more liberal use of modern conveyor systems and methods will increase production and cut labor costs. In fact, any speed-up of scheduling which will reduce the time of fabrication will bring savings resulting from more rapid turnover of investment. *(Continued on next page)*

1948 Index in Preparation

Get your copy of the Annual Index to the Copper Alloy Bulletin by writing to Bridgeport Brass Company and asking that your name be added to the Copper Alloy Bulletin mailing list. Those already on the Bulletin mailing list will automaticaly receive copies, now in preparation.

METAL OUTLOOK

(Continued)

Reducing Maintenance by Using More Corrosion-Resisting Metals

Corrosion, the enemy of all metals, is finding more opposition from copper and its alloys. Destruction from corrosion means expensive maintenance, shutdowns, repairs and eventual replacement, all of which involve high labor costs. As a result, more attention has been given during the past year to specifying more corrosion-resisting alloys and combinations of metals. This explains the unprecedented demand for copper tubing for plumbing, heating and refrigeration lines, and for water wells. Copper tubing is also replacing outworn, rustable underground gas mains.

Outstanding is the large increase in the use of Duplex Tubing — copper-steel for ammonia refrigeration and for the handling of nitrogen compounds. Much saving has been effected over steel tubing because of increased service life, better heat transfer and reduced maintenance. Other combinations of Duplex Tubing are doing much for the processing of petroleum products, chemicals and foods.

Serious pollution of streams and harbors is responsible for a wider use of corrosion-resisting Duronze IV* (aluminum bronze) and Aluminum Brass condenser and heat exchanger tubing in the power, marine and chemical fields.

To fight corrosion from moisture and weather we find that manufacturers are using more silicon bronze alloys for bolts, nuts, screws, marine and pole line hardware, equipment for waste treatment and sewage disposal plants, paper mills, etc. Duronze III* (silicon aluminum bronze) and other aluminum bronze alloys are also more generously used for valve stems, pump parts, valve seats to reduce wear and increase service life.

To sum up briefly — metal fabricators are meeting rising costs by more carefully selecting metals and alloys that are physically suited to their requirements as exactly as possible, are tightening up on their manufacturing operations, and changing methods of manufacture for greater economy.

Progress at Bridgeport Brass

Many gains have been chalked up on the plus side of the ledger. 1948 was a high production year for the Company. At Bridgeport, Connecticut, the mills worked at capacity practically all of the time. New production records were made by our Tube Mill as more and more of the new equipment swung into action.

Our new mill at Indianapolis also greatly benefited from the additional equipment which made possible the production of commercial gauges of strip and sheet and a full range of rod sizes and shapes. Its substantial volume of copper water tubing in straight lengths and coils also helped its growing production picture. Thanks are gratefully extended to our Mid-Western and Western customers for their support rendered to this great new mill.

With many unsolved problems at home and abroad, 1949 promises to be a year of changing conditions. Customers should feel free to call upon our laboratories in Bridgeport and Indianapolis, as we wish to be as helpful as possible in regard to their metal problems. *Reg. U. S. Pat. Off.

For fabrication of the many thousands of articles of everyday use, Bridgeport offers a wide choice of alloys in many forms. Modern mills in Bridgeport, Conn., and Indianapolis, Ind., and a staff of experienced laboratory-trained men are ready to help our customers quickly with their metal problems.

Sheet — Rolls, Strips — Brass, Copper, Nickel Silver, Phosphor Bronze, Silicon Bronze, Aluminum Bronze for drawing, spinning, stamping, forming.

Rod—High-Speed, Free-Turning Brass and Duronze III Aluminum Bronze for screw machine operations. Also, Naval Brass, Silicon Bronze, Aluminum Bronze. Bronze Welding Alloys.

Wire—Brass and Silicon Bronze for making screws, rivets, bolts, nuts, nails. Phono Electric Bronze trolley wire.

Tubing—Copper for plumbing and heating; Condenser and Heat Exchanger Tubing; Brass and Copper pipe.

Plumbing Brass Goods. Traps, sink plugs, basket strainers, bath wastes, basin supplies, shower curtain rods; radiator air valves for one-pipe steam heating systems.

Automobile Tire Valves — for passenger cars, trucks, farm tractors — valve caps, cores, gauges.

Aer-A-Sol Insecticide—DDT pressure container type for killing household insects.

NEW DEVELOPMENTS

This column lists items manufactured or developed by many different sources. None of these items has been tested or is endorsed by the Bridgeport Brass Company. We will gladly refer readers to the manufacturer or other sources for further information.

Circular Slide Rule, only 4½" in diameter, can be used to multiply, divide, determine squares, square roots, cubes, cube roots, reciprocals and proportions. **No. 901**

Automatic Loading Devices for rotary and rack type gear finishing machines are said to maintain production rates as high as 300 pinions per hour per machine by means of gravity chute feed, eliminating need for arbors to mount gears and pinions. **No. 902**

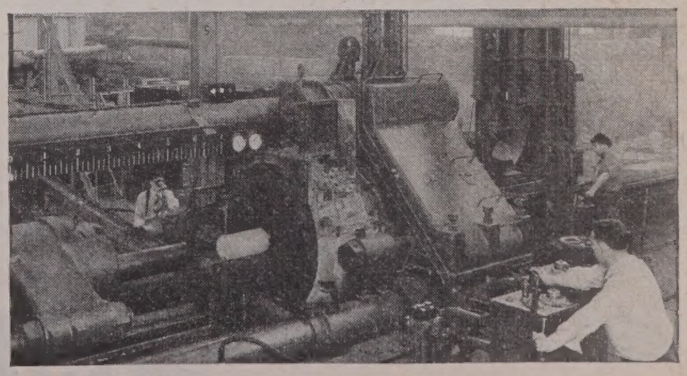
New Miniature Lathe is said to combine features of standard lathes with specialized design of jewelers' lathes for use in machine shop, tool room and laboratory as well as by watchmaker and jeweler. Measures 10½" x 7¼" x 3¾", with speed range from 100 to 3000 rpm. **No. 903**

Vernier Scale Magnifier, essentially an optical glass 3½" to 4 power lenses in spring brass frame, clips over head of reading scale to simplify accurate reading on both sides of vernier calipers. **No. 904**

New Metal Castings Sealant is reported to permit salvage of many castings rejected due to porosity. Impregnation is by vacuum pressure method, suitable for aluminum, magnesium, bronze, steel and gray iron, it is claimed. Anodizing or plating coatings can be applied, and sealant resists hydrocarbons, water, salts, solvents and moderate acids or alkalis. **No. 905**

Self-Feeding Tube Expanders are claimed to provide uniform expansion through entire thickness of sheet. Designed for precision rolling of condenser tubes from ½" to 1½" od, units are said to be particularly effective in rolling bimetal tubes. **No. 906**

Pocket-Size Plater's Computer is said to furnish data quickly for all types of plating operations, such as plating time to deposit given thickness of metal, current density required to deposit given thickness, thickness resulting from established plating time at known current density, cathode efficiencies of plating solutions, etc. **No. 907**



Indianapolis Plant of Bridgeport Brass—powerful 3850-ton extrusion press making brass rod from a red hot billet.

BRASS, BRONZE, COPPER, DURONZE, NICKEL SILVER, CUPRO NICKEL

"Bridgeport" BRASS CO.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

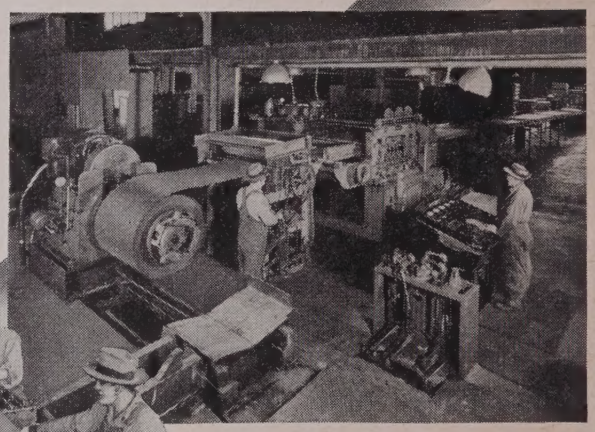
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

Warehouse Service with Slitting Facilities in Principal Cities

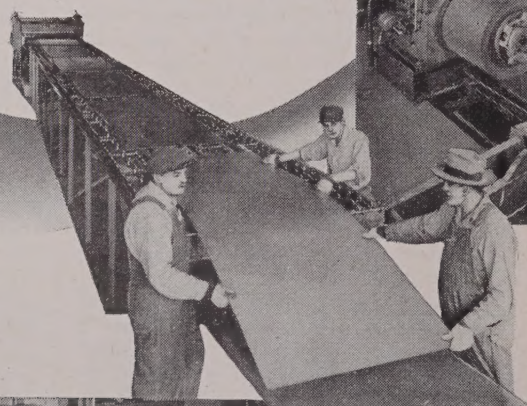
If You Use
SHEET STEEL...

Let International quote on decoiling, flattening, cutting, and pickling. Also on coil-slitting. International's mill-type equipment handles these services at low cost, and assures dependable supplies even though mill facilities are crowded.

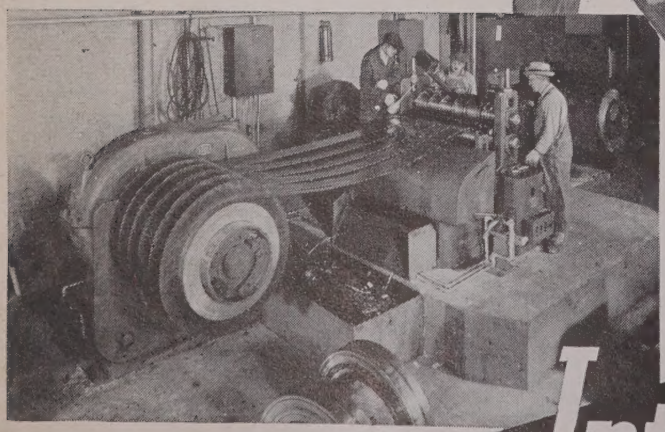
Hundreds of manufacturers look to International for steel service to assure a steady flow of incoming materials. Perhaps similar service can be arranged for you . . . it will pay to inquire.



Coils up to 9 gauge (.150) can be handled by International's Flying Shear



Sheets from the Flying Shear are smooth, uniform, accurate to size



One of International's three coil-slitters that handle coils up to 60 inches wide

STEEL I SERVICE INTERNATIONAL

International

ROLLING MILL PRODUCTS CORPORATION

5033 S. KEDZIE AVE., CHICAGO 32, ILL. **Phone HE 4-5200**

WITH SANDVIK SPECIALIZED SPRING STEELS

quality repeats itself...

When your "specs" call for uniform gauge, finish and physicals, piece-after-piece, specify SANDVIK.

SANDVIK specialty high carbon and alloyed strip steels are supplied:

- **In special analyses for specific applications**
- **Annealed, unannealed or hardened and tempered**
- **Precision-rolled in thicknesses from .001"**
- **With bright finish or polished bright, yellow or blue**
- **With round edges or square edges**
- **In a wide range of widths**

Phone or write for further information, technical advice or current stock lists.

SOME SANDVIK SPECIALTY SPRING STEELS

Band Saw Steels; Metal Band, Wood Band and Butcher Band • Camera Shutter Steel • Clock and Watch Spring Steels • Compressor Valve Steel • Doctor Blade Steel • Feeler Gauge Steel Flapper Valve Steel • Knife Steels Razor Blade Steel • Reed Steel • Shock Absorber Steel • Sinker Steel • Spring Steels • Tape and Rule Steel • Textile Steels • Trowel Steel • Vibrator Reed Steel

SS-38

Sandvik Quality Steels

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make
TOUGH
metal
CUTTING
Jobs
EASY

insist on
STAR *blades*

Want to zip through the toughest metal cutting jobs in jig time? Of course, who doesn't?

Then be sure you're using a Star hack saw blade. They're designed and made to make cinches out of tough cuts. Only the finest steel is used — automatic machines shape teeth precisely — special heat treatment provides extra blade strength. As a result you get a faster, cleaner cutting blade that lasts longer.

A complete Star line is made for all types of metal and plastics cutting and for either hand or power equipment. Ask your dealer to show you Star.

AT YOUR DEALER'S NOW!
Your free copy of Star's booklet, "METAL CUTTING" and the new Star Wall Chart. Ask for these helpful guides to better selection, use and care of your hack saw equipment.

4641

CLEMSON
CLEMSON BROS., INC.
MIDDLETOWN, N. Y.

Manufacturers of Hack Saw Blades and Frames, Metal Cutting Band Saw Blades and the Clemson Model E-17 Lawn Machine.

Fatigue Cracks

BY C. T. POST

On Our Way

• • Not that 1948 was a bad year. Most of your favorite family journal's loyal readers worked with a full belly. But just under the hairline frustration and fear were neighbors. Like Donora's famous fog, nobody knew for sure whether the atmosphere was poisonous, but it gave people the shakes.

Just a year ago, every company that used steel in its products had orders sticking out of every pocket. No steel to be had. Many tried aluminum. Shortly, there was no aluminum to be had. Everyone, almost, was showing a good profit on the quarterly statements. But the profit that got away for lack of material, the big killing, the hot dog-on-the-stick-constantly-moving-in-front-of-the-dog, added up to nothing but frustration.

In the roaring twenties a steel mill was something discussed in awed tones even among the big investors. In 1948, many of the big thinkers of industry solved their steel supply problem by pushing a buzzer for the purchasing agent, commanding simply, "Go buy us a steel mill, John."

Some of the smaller steel users banded together, tried the same thing. First, they bought a sheet mill. Then they found they had no source of raw steel, so they bought another mill with some open hearths. Scrap got tighter and tighter, and no pig iron was to be had on the open market. Our brave little band finally had to turn their two mills over to another group that had some blast furnaces.

Never before have blast furnaces been bought and sold like cattle, with accompanying feuds in the full blown color of frontier days.

We've had strangers in our midst, too. Men that offered, from the corner of their mouths, thousands of tons of cold rolled sheets; men whose only experience with cold sheets had been when they crawled into bed; men who actually had no sheets, but who knew a man who knew a man who thought he knew a man who could get some. Funny thing, there was big money in the business.

Not since the last time we played musical chairs have we seen such a universal fear that the music would stop, leaving some manufacturers with no place to sit down. Judging from reports the past few weeks, these fears have been well grounded. Most of the kiddies still have seats, some of them still are lolling in overstuffed armchairs, but the atmosphere is tense.

There's little pity from the consuming public for companies which have run into difficulties. As the ebb tide runs stronger, the blessed multitude, the saintly "little man" is showing a vicious vindictiveness toward the supplier whose goods he was begging to buy a year ago. The chap who hasn't been able to buy parts for his 1940 car for the past 3½ years, who meanwhile has seen new cars going to the buyer who would take more accessories than he could afford, is lying in wait with a club for the first new car salesman who comes to his door. Nobody that we can recall wanted revenge when things began to slip in decades past.

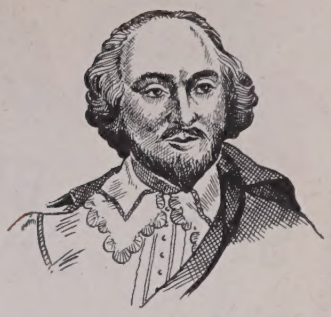
Revenge may be sweet, but it has a bitter aftertaste. If markets drop and plants close, the little man may be out of a job. That's not a nice prospect either.

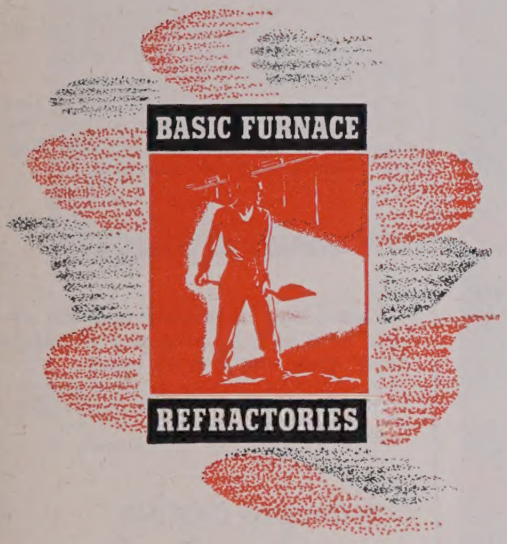
Things may not be so bad in 1949. There's rearmament for ourselves and Europe and who knows what comes next. That means orders, jobs. But orders and jobs from rearmament don't tend to make the economic atmosphere any more serene.

* * *

This adult game of musical chairs isn't quite as tough as the childhood version, though. Barring the atomic scientists, no one thinks we're going to get down to one chair—or none. There will always be a place for the business that moves and thinks fast and keeps its wits. Some may even achieve a degree of immortality. Take Inland Steel's cartoon figure of "dead weight," used to illustrate its advertisements for Hi-Steel. Darned if "dead weight," or at least a first cousin, didn't turn out to be Al Capp's Shmoo, most lovable little creature of the year. When word gets around that Inland Steel can produce Shmoos, the rush for steel will be as nothing.

What's in a name?





WHAT do the trade names Magnefer, Syndolag, Basifrit, Ramset, Gunmix and Gunchrome mean to you?

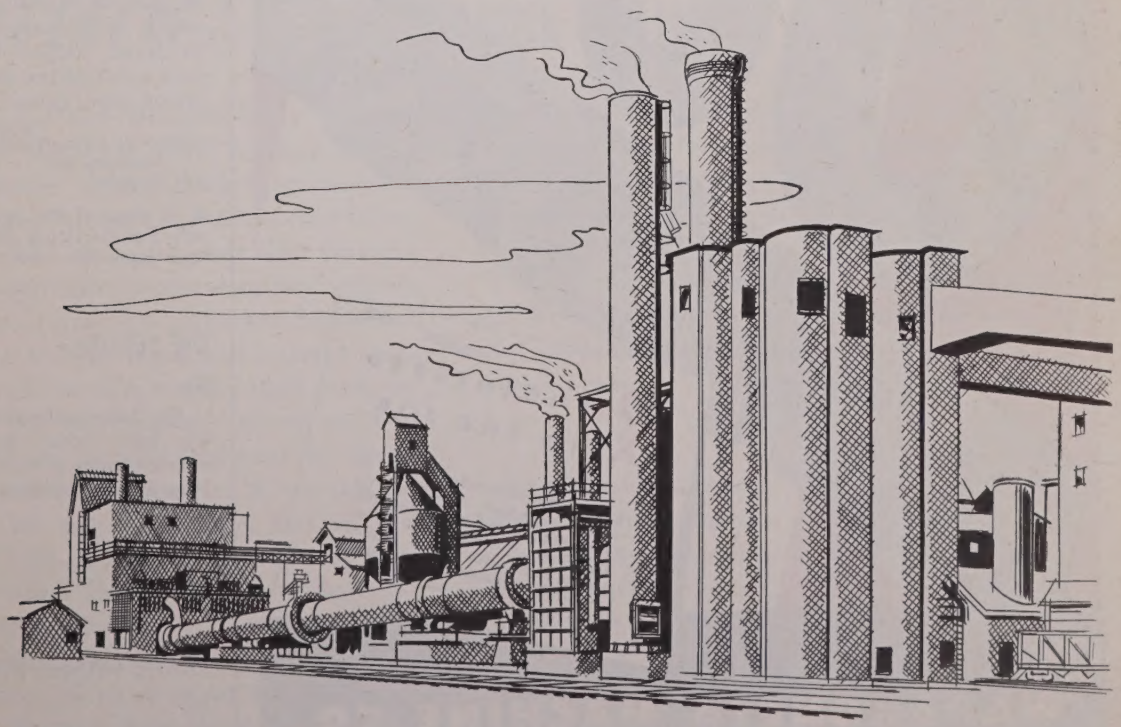
They are names familiar to every open hearth and electric furnace man—names that stand for dependable refractory products—backed by the resources and experience of Basic Refractories, Inc. in over 30 years of refractory production—

—a staff of more than 40 technicians—men and women who are engaged in daily research, development and production control.

—a record of leadership as evidenced by the introduction of magnesia ramming mixes, basic and neutral gun refractories and such refinements in dead burned dolomite as tar sealing, the container car and controlled sizing.

—a modern plant, representing an investment of more than $4,000,000, devoted exclusively to the manufacture of basic and neutral refractories and the processing of raw dolomite for refractory, commercial, fluxing and agricultural liming uses.

—finally, a field force of refractories specialists who are at your service, for consultation and help on refractory problems — to see that you get the utmost from Basic Refractories products.



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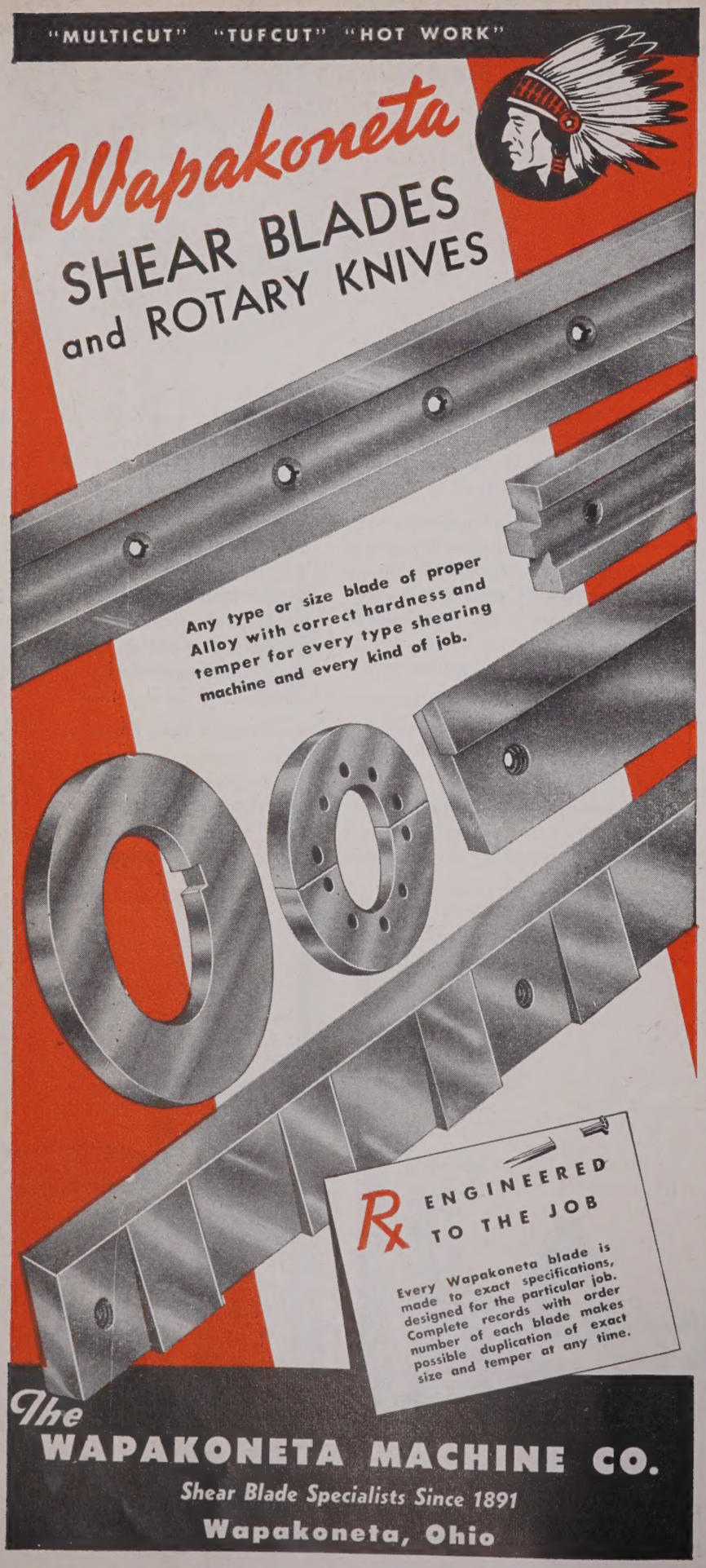

Dear Editor:

PRECISION CASTING

Sir:

I am preparing a report on the lost wax process of precision casting. Our library does not have all the issues of IRON AGE, and I have found in consulting the Industrial Arts Index that quite a few articles have appeared in IRON AGE on the subject. Could you advise me as to how I can obtain reprints of these articles?

JOHN L. HARNACK
School of Mech. Engineering
California State Polytechnic College
San Luis Obispo, Calif.

● Many of the articles on the subject have been reprinted in a booklet entitled "Precision Investment Casting—Lost Wax Process." Copies are $1.00 each.—Ed.

DISCOVERERS OF STAINLESS

Sir:

Please send tear sheets of the article "Who Discovered Stainless Steel" from the Oct. 10 issue.

J. A. CAMERON
Metallurgical Dept.
Elliott Co., Inc.
Jeannette, Pa.

CONTINUOUS CASTING

Sir:

We will appreciate a copy of the reprint, entitled "Continuous Casting of Semi-Finished Steel," from the article which appeared in the Aug. 19 issue. Also, if possible, please send a list of the steel mills manufacturing pipe, tubing and steel plate.

LEROY A. MUFFLER
Universal Consolidated Engineering Products Co.
Los Angeles

● A copy of the reprint and lists of the mills manufacturing pipe, tubing and plates have been sent.—Ed.

DIE SETTING

Sir:

We have received our Nov. 18 issue and would like to obtain three extra copies of the articles "Die Setting and Economical Punch Press Operation."

M. FRAZE
Purchasing Agent
Hardy Mfg. Corp.
Pendleton, Inc.

TRADE NAMES DIRECTORY

Sir:

About two years ago we received as a premium with our subscription a copy of your "Directory of 10,000 Trade Names." The book has been very useful, but in the last week it

25,000th Monarch Lathe with exclusive Flame-Hardened Ways; a 14″ x 54″ Series 60 Engine Lathe purchased by B. F. Goodrich Co.—one of many repeat orders from this customer. Customer's Engineering Division was represented by its Master Mechanic in charge of Machine Tool Operations, as the lathe was made ready for shipment.

Unretouched photograph of bed of Monarch 12″ Engine Lathe after eight years' severe service. Inspector's report shows no measurable wear of ways.

Salute! from a Veteran to Its 25,000th Brother

"SO you're the 25,000th Monarch Lathe with the famous Flame-Hardened Ways! You look so sleek and sure—*and accurate*—I don't blame your purchaser for being proud of you. Monarch's just as proud of me.

"Let me tell you why. I'm eight years older than you—and I've seen a lot more service than any *ordinary* lathe ever lives to see. I went to work back in September, '40. Right after that the war began, and I started working 24 hours a day, seven days a week. Hard work, too—I was turning out short pieces—plenty of short motions of my carriage, the kind that wear you down. And even though I told my operator it was bad, he often cleaned me off with an air-hose! But all that didn't stop me—I kept right on turning out war parts 'round the clock—each one with as fine a finish, as close a tolerance as the first I ever turned.

"Well, the war finally ended—but I kept right on working—though they did let up on my hours. I work a regular eight-hour day now, right along with the other master craftsmen. Recently my owners decided to hedge on rising production costs by sending me back to Monarch to be fitted out with the latest in time-saving, money-saving attachments. That's how I happen to be here for your christening party.

"But let me tell you what they've just found out about me. When they came to tear me down for inspection, they couldn't even find *any* measurable wear on my ways! Now do you blame 'em for being proud of you—and me?"

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The famous Monarch Flame-Hardening Process is an exclusive construction feature of every Monarch Lathe—one of many "pluses" to give you *peak production at a profit.* Write for complete details.

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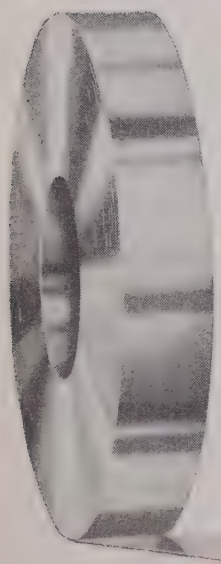

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has been lost. We would appreciate your sending, with bill, another copy of this book and also a copy of your "Tool Steel Directory."

O. J. ARNOLD
Steel Buyer

Glenn L. Martin Co.
Baltimore

● A copy of each directory is in the mail. Charge for the "Trade Names Directory" is $3.00, and for the "Tool Steel Directory," $2.00.—Ed.

ESTABLISHING STANDARDS

Sir:

I would like to obtain a copy of the article "The Standards Department—Its Organization and Function" which appeared in the May 27 issue.

R. E. HOSPES
Assistant Chemist

Aluminum Seal Co., Inc.
Richmond, Ind.

TOOL HEAT TREATMENT

Sir:

Having noticed in your letters to the editor column that you have reprinted the five articles entitled "Practical Tool Room Heat Treatment" which originally appeared in 1946, we are very much interested in obtaining a copy.

A. SHETTIGUE
Foreman, Tool Room Hardening Div.

Independent Lock Co.
Fitchburg, Mass.

CARBON MOLD PLUGS

Sir:

We are interested in securing a copy of the article "Carbon Mold Plugs" which appeared in the Nov. 27, 1947 issue.

D. E. STINGEL

Electro Metallurgical Co., Alloy Works
Alloy, W. Va.

HARD FACING WELDING

Sir:

Would you kindly send three copies of the article "Effect of Welding Practice on Abrasion Resistance of Hard Facings." This paper appeared in the Oct. 7 issue.

L. R. CONSTANTINE
Welding Engineer

Elliott Co.
Jeannette, Pa.

USING FASTENERS

Sir:

Please send a copy of the article "Effective Use of Fasteners" as published in the Sept. 23 issue.

C. P. SHERMAN
Aero. & Ord. Div.

General Electric Co.
Schenectady, N. Y.

HOT DIP GALVANIZING

Sir:

Please send me copies of the articles "Effect of Lead in Hot Dip Galvanizing Baths," from the Jan. 9, 1947

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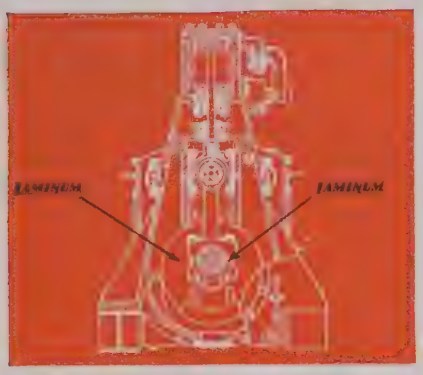

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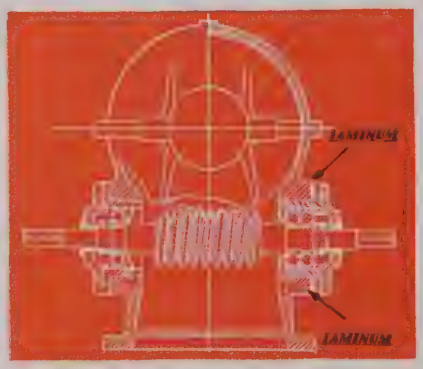

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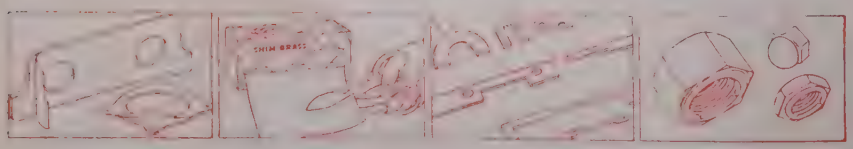

SHIMS SHIM STOCK STAMPINGS AN-COR-LOX NUTS

issue, and "Hot Air Dryer Doubles Galvanizing Output," from the Aug. 8, 1946 issue.

WM. J. MANCHESTER
Purchasing Agent
Union Mfg. Co.
New Britain, Conn.

X-RAY ANALYSIS

Sir:

Kindly let me have tear sheets of the article "X-Ray Fluorescence Analysis" from the Oct. 28 and Nov. 4 issues.

HERBERT R. ISENBURGER
St. John X-Ray Laboratory
Califon, N. J.

ALLOY STEEL HISTORY

Sir:

Will you please send me a set of tear sheets of the article "The Alloy Steel Industry—Its Early History" which appeared in the Oct. 14 issue.

H. W. WHITNEY
Metallurgical Engineer
Bliss & Laughlin, Inc.
Harvey, Ill.

OXIDE FILMS

Sir:

Will you please send tear sheets on "Metal Oxide Films at Elevated Temperatures" from the Aug. 12 and 19 issues.

KARL H. KROHN
Asst. Purchasing Agent
Eitel-McCullough, Inc.
San Bruno, Calif.

QUEBEC-LABRADOR ORE

Sir:

We would appreciate receiving tear sheets of "Kaiser's Gamble at Fontana," appearing in the Oct. 7 issue, and of "New Quebec-Labrador Iron Ore" and "Rearmament Program Exerting Little Demand for Magnesium" from the Nov. 4 issue.

OSWALD SCHMIDT
University of Pittsburgh
Pittsburgh

X-RAY ANALYSIS

Sir:

We should greatly appreciate receiving tear sheets of the article "X-Ray Fluorescence Analysis" which appeared in the Nov. 4 issue.

H. C. FRIEDEMANN
American Electro Metal Corp.
Yonkers, N. Y.

ELECTRIC FURNACE PRACTICE

Sir:

Will you please send a copy of the article "Single Slag Basic Electric Furnace Practice" which appeared in the Sept. 30 issue.

GEORGE T. STEPHENSON
Purchasing Agent
General Metals Corp.
Oakland, Calif.

CUPOLA DUPLEXING PLANT

Sir:

We would like to obtain two copies of "Water-Cooled Cupola Features

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M-29

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Duplexing Plant" from the Aug. 19 issue.

D. M. KINCH
Librarian
Great Lakes Carbon Corp., Electrode Div.
Niagara Falls, N. Y.

PIPE AND TUBE MILLS

Sir:

We would appreciate very much receiving a list of pipe and tube manufacturers located in the United States.

J. R. DAVIS
Distributor Sales Sect.
International Nickel Co., Inc.
New York

● The list has been mailed.—Ed.

SOURCES OF SUPPLY

Sir:

In the past we have written you for information on a number of things and have received very satisfactory results. We are calling on you again to help us find suppliers of the following materials: cobalt, chromium, iron, molybdenum and silicon. We should appreciate the names of companies from whom we can obtain the above materials in small quantities.

E. A. BENDEROTH
Warren Laboratories
Baltimore

● Names of companies supplying the materials have been sent.—Ed.

DURNER CO. SUCCESSOR?

Sir:

Can you advise us who took over the A. E. Durner Co. of Evansville, Wisc., makers of the Giant Wonder Disc Sharpener?

A. J. WISS
President
Pana Iron Store Co.
Pana, Ill.

● No, we haven't the information. However, either Farm Implement News, Chicago, or Implement and Tractor, Kansas City, can probably help you.—Ed.

TRADE NAMES

Sir:

Please send us one copy of "Directory of 10,000 Trade Names" at the price of $3.00.

J. VAN TIJN
Mining Euipment Corp.
New York

TOOL STEEL CHARTS

Sir:

I would greatly appreciate it if you would furnish two tear sheet copies of the charts "Comparative Tool Steel Brands" from the issue dated July 29.

PAUL C. SANDMEYER
Sales Manager
Stainless Steel Sales Corp.
Philadelphia

THOMAS L. KANE
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The IRON AGE

Vol. 163, No. 1 — January 6, 1949

Ninety-Fourth Annual Review Issue

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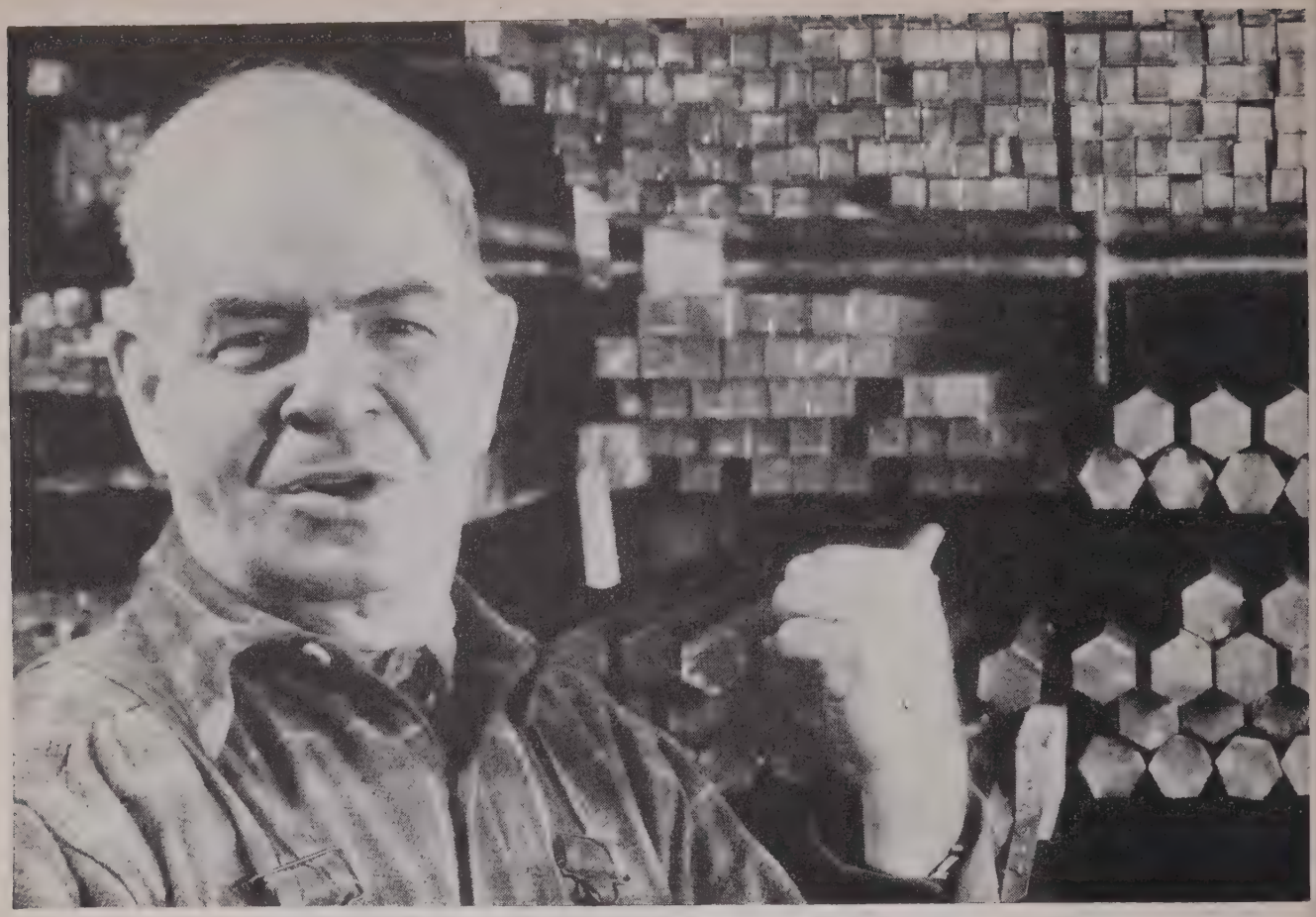

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Poverty for All

FROM Great Britain comes a significant announcement. Sir Stafford Cripps tells us that in 1939 11,000 Englishmen had net incomes of more than $20,000 a year. In 1948 only 250 could boast incomes in excess of this figure. With a note of triumph, Sir Stafford announced this "socialist progress" to a press conference. It was part of "a veritable social revolution" which had created "greater equality of income" in Great Britain.

It is well to note the emphasis which the British chancellor places on two aspects of this change. The first is the cause, namely, "a veritable social revolution," and the second is the effect, namely, "greater equality of income." In other words, the change had been deliberate and the end was precisely what the doctrinaires of the British Labor Party had sought.

Henceforth no matter what talent a boy laid on the line, however hard he worked or how intensely the flame of personal ambition burned, the full power of the English government would be used to prevent him from realizing his fair rewards.

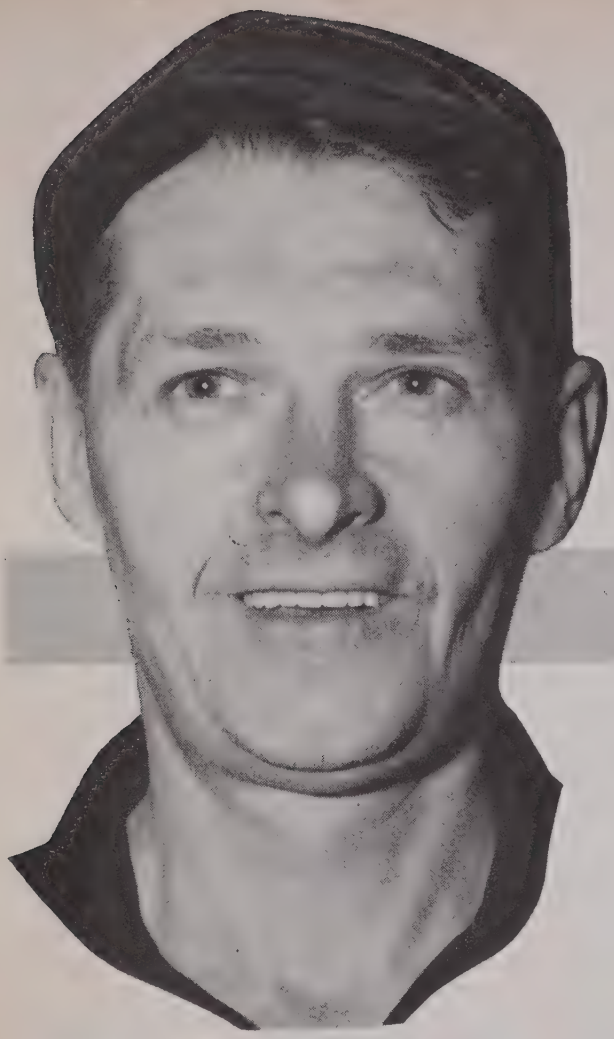
Let us not forget that the high returns which go to men of conspicuous merit in a free society are the result of open processes in which the fellow-citizens of the successful pay a voluntary price for their services. The great singer, the gifted pugilist, the talented actor, the shrewd speculator, the able executive—all expose themselves constantly to the judgment of their fellow-men. When Joe Louis gets a half million for a fight that lasts only two minutes, when Bing Crosby collects $5,000 for a melody which he enjoys singing, when a business leader gets a quarter of a million in a position for whose fame and influence others would cheerfully pay that amount, it is because a vast jury of their own peers believe they are worth it.

Such open market valuations of human service constitute the town meetings of a free economy. These votes of value are the very essence of the democratic process. When socialist dogma interposes its sterile judgment and denies the successful individual that measure of material acclaim which his fellows voluntarily offer, it is depriving these citizens of their birthright and circumscribing the area of freedom.

The "greater equality of income" which Sir Stafford exultantly proclaims, should be a warning to the American public and to Congress which will soon be asked to pass on further grants to the British government. If Sir Stafford had announced a deliberate sabotage of English industry with sand for its bearings and monkey wrenches for its gears, America would be properly shocked. Our editors and legislators would ask why America should make sacrifices for a supplicant who deliberately undermines his own means of self-help.

The human resources of England, particularly the energetic, intelligent and courageous leaders at the top, almost all of whom are included in the group, whose members have been decimated by the "social revolution," are infinitely more important to the British economy than the physical equipment of English industry. When British socialism sabotages management by destroying its incentive, the action calls for an epitaph and not an encomium.

Joseph Stagg Lawrence



"I like the UNIFORMITY of Inland Steel"

THE MEN WHO WORK WITH INLAND STEEL KNOW ITS QUALITY!

Operators of forming rolls know that the steel they process must have a uniform temper—strong enough to do its job, yet ductile enough to fabricate without fluting. That's why they prefer Inland Steel. Uniform sources of raw materials . . . uniform steelmaking procedures using the same modern equipment . . . uniform workmanship—made possible by Inland's completely integrated, closely knit plant—explain why the Inland steel received today will be of the same uniform quality as that received last month . . . or last year.

INLAND STEEL CO., 38 S. Dearborn St., Chicago, Ill. Sales Offices: Chicago, Davenport, Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul.

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OTHER PRODUCTS: BARS • STRUCTURALS • PLATES • STRIP • TIN PLATE
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► When substantial tonnages of iron ore begin moving from the Quebec-Labrador deposits, a major railroad that hauls coal to the seaboard is considering carrying iron ore on the return trip to some major consuming points in the Midwest--at a reduced rate.

► American steel companies will have increased their ability to make ingots by more than 5 million tons in the 2-year period ending Dec. 31, 1949. About half of this big gain will come from new steelmaking furnaces; the balance from equipment designed mainly to improve raw material quality and quantity.

► British builders will construct a 5-place monoplane almost wholly from magnesium. The tapering fuselage tube will use welded magnesium sheet sections of sufficient thickness as not to require stiffening ribs or stringers behind the cabin. Magnesium will also be used for the propeller shaft and engine block. An estimated saving of 35 pct in weight is indicated by this construction.

► World steel production hit a new peacetime high last year. The estimated 168,812,000 net tons that was made is still about 15 million tons short of the 1943 wartime peak but far above the 1939 peacetime high of 150,780,000 tons. Expansion programs in the various countries point toward an output of near 200 million tons in the period between 1950 and 1952.

► To prove the feasibility of the proposed forging of wing spar caps for military aircraft and justify the cost of a new 60,000 ton forging press, two German presses are being brought to this country. One is a 10,000 ton press while the other is a 15,000 ton unit. Both will be set up and operated. General design of the 60,000 ton press has been completed. But at present funds are not available for detailed designs or construction.

► Increasing freight rates since 1938 have meant that the freight absorption dollar has shrunk by two thirds on hauls in the 500 to 600 mile bracket. Prior to 1938 it was possible to ship 100 lb of finished steel in the short haul bracket, 55 to 75 mi, for 10¢. Today 10¢ will buy only 25 to 52 mi.

► Large makers of electrical equipment have started to cut back on some of their steel demands. Last week steel producers received cancellations or holdups on shipments of electrical sheets. These companies are not small. They are the blue chip organizations of the electrical world.

► A prominent Detroit steel buyer has estimated that the delivered price of hot rolled 16 gage sheet bought in Pittsburgh has increased 57.2 pct since 1939. The increase in the delivered price of 16 gage sheet cold rolled out of Pittsburgh is 48 pct. During the same period the delivered price of hot rolled strip 16 gage (one producer excepted) has jumped 65.5 pct while cold rolled strip has climbed an estimated 41.3 pct.

► A big slice of the $2 billion that steel companies are spending on postwar improvements will bring finishing equipment more nearly in balance with melting facilities. The 2½ to 3 million tons of ingots sold on conversion deals during 1948 showed up finishing facility shortages like a sore thumb.

► Though designed to improve quality rather than save zinc, at least one of the new continuous galvanizing lines is showing a nice cost saving due to the current high price of zinc. The gain comes from the more uniform coating deposited and in this case averages almost $4 on each ton of galvanized sheet produced on that line.

► Some of the demand steel in the voluntary allocation programs may be fictitious. Coal mining machinery is an example. Machinery makers are nearly caught up. Coal stocks are at an all time high. Productivity is high in the mines. Consumers are choosy about quality. This program could fall apart at any time.

► The importance of metal finishing costs in automobile manufacture is illustrated by the fact that most bumpers are now cold formed out of low carbon, high tensile steel instead of from the hot formed spring steels formerly used. A factor here is the complex design of modern bumpers which makes it difficult if not impossible to form the parts from spring steels.

► Contrary to the belief of many, 1948 was not a record peacetime year for freight tonnage moved by American railroads. The peacetime record still stays with 1947 while 1948 is 2.3 pct below that.

► Lower prices for steelmaking scrap are being talked by both buyers and sellers. Several mill buyers look for a break early in 1949. Some brokers say a drop is unlikely before March. No one will estimate the amount but it apparently won't be big.

armed services procurement

Purchases by the armed forces are again assuming a major role in the nation's economy. In an effort to answer briefly but helpfully the question being asked by thousands of metalworking plants—"How can I sell to the armed services?" the chairman of the munitions board tells in this article, in plain language, the steps management should take to assure participation in this $6.1 billion market.

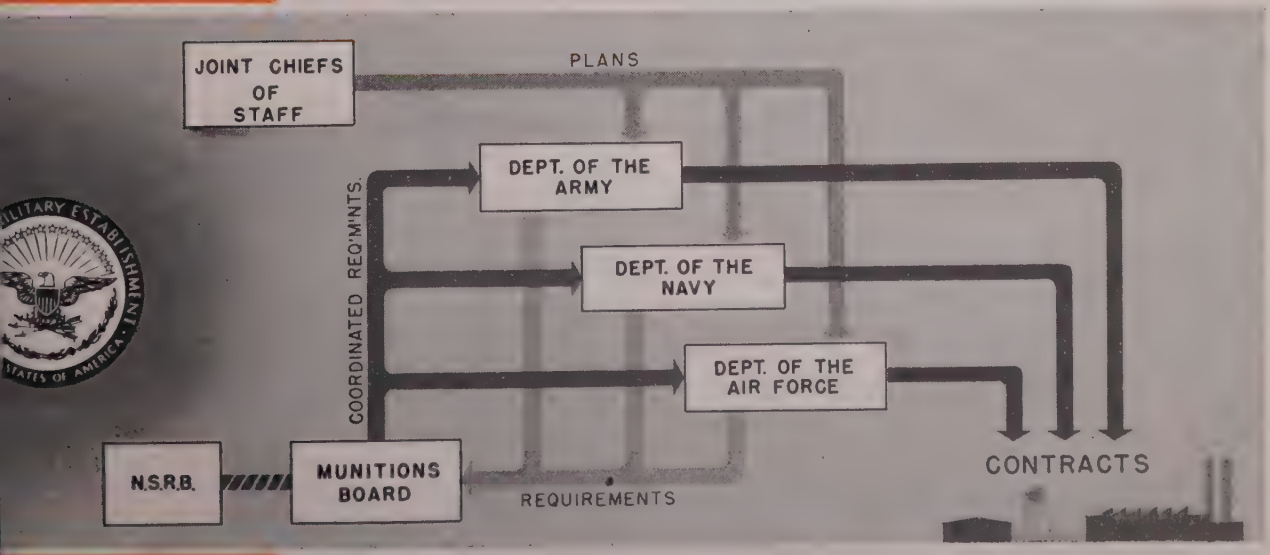
By DONALD F. CARPENTER
Chairman, Munitions Board,
NATIONAL MILITARY ESTABLISHMENT

Rearmament has transformed the Armed Forces into one of the largest potential, if not actual, peacetime buyers of all times. It is small wonder that businessmen the country over are casting slightly distended eyes at the $6.1 billion to be spent by the services for materials and equipment in the year ending June 30, 1949. It is even less amazing that thousands of firms with something to sell are clamoring for simple directions on how to obtain contracts with the departments of the National Military Establishment.

Floods of inquiries swell the mails and multiply the tasks of Congressmen, the Secretary of Defense, the secretaries of the various departments, the Munitions Board, and anyone else in or out of Washington who producers suspect may be able to furnish tips on "selling to the government."

It is the purpose of this article to offer general information and suggest general lines of action which will help businessmen sell to the Army, Navy, and Air Force. It is not intended to be a detailed, exhaustive manual on "Selling to the Armed Forces." It is hoped, however, that the information and suggestions offered will serve to guide the prospective supplier far enough along the path to the all-important dotted line so that he will be able to make the remainder of the trip by simply exercising a modicum of horse sense.

At the outset of your quest for contracts, it would be well to make sure that you are not confusing Industrial Mobilization Planning and the Facilities Allocation Program of the Munitions Board with current procurement. This program has to do with advance planning for the most efficient and speedy use of the Nation's productive capacity and manpower in time of emergency. Perhaps a portion of your plant capacity has been allocated to one of the services, or it has at least been surveyed. This allocation, or survey, does not mean you are about to be called upon to produce material or equipment for the services. By the same token it offers no reason to throw your present distributors into an uproar by telling them you won't be able to supply them much longer because you will soon be turning out



stuff for the Army, or the Navy, or the Air Force.

The possible periods of emergency, which prudence dictates we must plan to meet, may never arise. Any one of many events may change plans overnight. For example, the introduction of a new weapon or new type of equipment might change or cancel many capacity allocations. If you feel a bit dim on how Industrial Mobilization, the Facilities Allocation Program, and current procurement differ, or if you believe your plant should be included in the Facilities Allocation Program, two pamphlets issued by the Munitions Board would be of help. One is "Military Procurement, A Guide for Joint Industry-Military Procurement Planning." The other is "Allocation for Procurement Planning of the Armed Services." These booklets may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington.

Another important point to bear in mind if you want to avoid false trails and needless expense is that, with few exceptions, military buying is done almost everywhere in the United States except in Washington. The most important exceptions, as far as dollar volume is concerned, are items procured by Bureaus of the Navy which will be discussed later. It also should be emphasized that the law prohibits the Armed Services from paying a contract price which includes any fee for a business representative not regularly employed by the supplier (excepting bona fide employees or bona fide established commercial or selling agencies maintained by the contractor for the purpose of securing business).

Another valuable bit of information to the potential supplier is the fact that the Munitions Board is assigning to single services the responsibility for buying certain items for all three military departments.

The Navy buys combat ships and landing vessels, solid fuels and hand tools, clocks, steam engines and steam turbines. The Army buys all subsistence items, lumber and allied products, mess and galley gear, recreation equipment, safety and protective chemical warfare supplies, railroad transportation equipment, motor vehicles and tractors. The Air Force buys photographic equipment.

This arrangement has distinct advantages for the potential supplier as well as the services. For example, suppose you want to sell the services dredging machinery. There is no need to buzz into Washington and out again; from the Navy to the Army to the Air Force and back again. You concentrate on doing business with the Chicago Procurement Office, Corps of Engineers, 226 West Jackson Boulevard. That's your only customer as far as the three military departments are concerned.

One of the benefits to the supplier from single service and joint procurement is the fewer contracts required.

The Military Establishment obtains medical supplies and equipment, petroleum, oils and lubricants by joint procurement, which from the sellers' standpoint is the same as single service procurement.

Office supplies, textiles and clothing are bought by the three departments through collaborative procurement. Under this arrangement, purchasing offices of the departments are located close together for ease in exchanging marketing information. By the same token, the proximity of these offices will make the job of selling easier, too.

MEMBERS of the Munitions Board. Top row, left to right: Maj. Gen. P. W. Timberlake, director for requirements and facilities; Lt. Gen. LeRoy Lutes, director of the staff; Rear Adm. F. C. Denebrink, director for procurement, manpower and utilities; Maj. Gen. Sidney Spalding,

It will be helpful to know that, generally speaking, there are three types of selling for which current military procurement provides the potential supplier with a market. The supplier may receive a prime contract to supply material or equipment. As a subcontractor he may supply the prime contractor, in which case he will benefit directly from military expenditures but will have no dealing with the military departments. It might be well to note here that the services rarely, if ever, buy components as such. A third outlet not to be passed over lightly is selling for local use to

director for materials and international matters. Bottom row, left to right: Gordon Gray, asst. secretary of the army; W. John Kenney, under-secretary of the navy; Donald F. Carpenter, chairman of the board; Arthur S. Barrows, under-secretary of the air force.

Army bases, Navy shore stations and any of the 300 individual Air Force installations.

The prospects of selling the Armed Forces on educational or educational production contracts probably have been greatly overrated in print. Some educational production contracts are being let to plants under allocation to various services as part of the Industrial Mobilization program. They are solely to enable a plant to get the feel of production of some item if future emergency should demand it. The services generally discourage suppliers from expecting any appreciable business from this type of contract.

Sales are made to the military departments on contract. The ordinary method of letting contracts is through advertising for bids. Contracts through negotiation are permitted, briefly, when secrecy is essential, to cover research and development work, to cover contracts with educational institutions, and to permit the procurement of personal or professional services. A copy of the Armed Services Procurement Act of 1947 (Public Law 413—80th Congress) obtainable from the Superintendent of Documents, U. S. Government Printing Office, Washington, spells out conditions governing the two methods of contracting in easily understood language.

Many firms want to know whether the government helps finance current procurement. Under present legislation, the only form of financial aid to contractors from the government is advance payments, and these only in isolated instances. Briefly, they are authorized only in instances of negotiated purchases when no other contractor is available to furnish satisfactorily the desired supplies or services, and in the case of non-profit research and development contracts with educational institutions.

With these generalities well digested, obviously your next step is to find out what the services want to buy; determine if you do or can make any of the desired items, and if so, find out who buys your particular product and try to do business with this purchasing office.

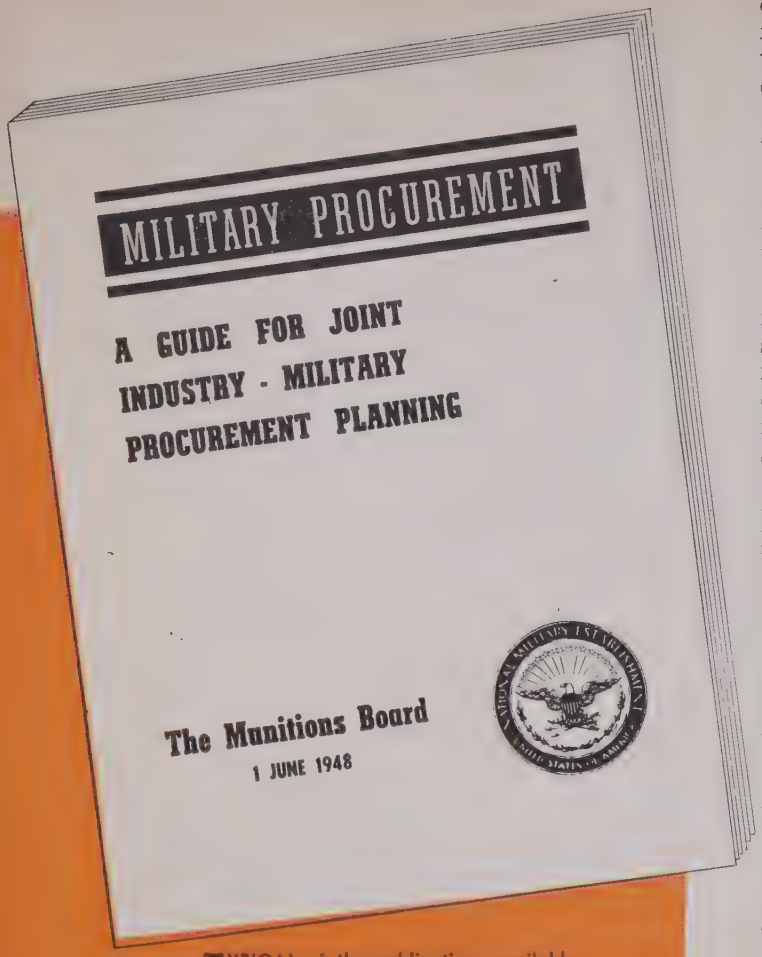
But is this line of action so obvious, after all? Perhaps it is not too surprising that there is abundant evidence to the contrary.

Many businessmen, either because of the nature of their competition or the type of items they handle, have grown to look upon selling almost entirely in terms of sales appeals through advertising campaigns and other business techniques, including personal salesmanship. It is not meant as an adverse criticism to say that many of them, in addition, complicate their problem further by a firm conviction that selling to the Armed Forces depends on "knowing the right person" rather than finding the right person.

Consequently, many businessmen who follow these lines of thinking make speculative trips to Washington, bustle into the Pentagon with a high priced business representative under one arm, so to speak, and a portable swimming pool or a plastic horse collar under the other, confident they can "put the customer into the market" for their specialty. Something like this happens every day. As a selling technique it succeeds probably less than once a year.

Finding out what the Armed Forces want to buy and who does the buying need not be the shocking plunge into a sea of utter confusion which it is so frequently pictured if you are willing to start with a few three-cent stamps rather than an exhausting marathon around the corridors of the Pentagon and the Navy Building.

The Procurement Policy Council of the Munitions Board and the services have just developed on a single page a listing of items assigned to single service, doing procurement which would account for 70 pct, dollar value, of the fiscal 1949 expenditures for materials and equipment had the assignment been effective throughout the year. Each item is followed by a symbol. This symbol is used to indicate on the same sheet the name and address of the agency charged with buying these items. A letter addressed to the Munitions Board, National Military Establish-



TYPICAL of the publications available to industry explaining the various phases of military procurement, the facilities allocation program, etc., is the one shown here.

ment, Washington 25, will bring you this "Index of Military Purchasing Offices—a Guide to Military Purchase Responsibility for Selected Items."

This sheet should prove an invaluable help to potential suppliers in contacting the right procurement office quickly. It won't help, of course, with the items the three military departments buy solo or for local use.

Information on procurement of items in these categories as well as some of the finer points of selling to the Armed Forces can be obtained by studying the procurement practices of each service individually.

One practice common to the three services is the keeping of bidders' lists at their various purchasing offices. Prospective suppliers should write to the office handling the items they wish to sell and ask to be placed on the bidders' list.

Describe and identify fully the items you wish to offer. If possible, try to establish in the first letter the status of your firm as an acceptable bidder. To do this, describe the capacity of your plant, your financial status, the engineering service you are prepared to offer, and any other relevant information. If the information you furnish is adequate, you will be added automatically to the bidders' list. If not, you will probably receive a form to fill out.

If you repeatedly fail to respond to invitations to bid, you will be dropped from the list.

No attempt here can be made to describe in great detail the procurement setup of each service. However, some general information, service by service, follows:

ARMY—In addition to the Army's own items not procured by other services, and its single service procurement assignments, Army buys for various programs in Occupied Areas and for distribution by ECA to Marshall Plan countries in Europe. Of necessity, it must maintain a wide spread system of purchasing offices.

The addresses of the Army's 90 purchasing offices, including those which buy for Civil Works projects, together with a list of items procured by each office are to be found in a pamphlet, "Purchased Items and Purchasing Locations." It may be obtained by writing Current Procurement Branch, Logistics Div., General Staff, U. S. Army, The Pentagon, Washington 25.

In addition to much other valuable information about selling to the Army, the pamphlet explains in considerable detail how local purchases are made. This form of buying has proved an attractive source of revenue for hundreds of small businesses.

The pamphlet states, "many items including those not normally stocked, are purchased locally at posts, camps and stations. Commodities concerned may be any item of supply and include, but are not limited to, certain highly perishable goods; equipment, supplies and services required for maintenance or other special needs for installations; materials or supplies entering into the manufacture of end items produced by a manufacturing arsenal or depot; printing, binding, repairs or other services for which a need arises at an installation; items temporarily out of stock and all purchases by Army and Air Force post exchanges in the United States. Local purchases, usually of limited dollar value, may be effected at any installation, including the purchasing offices listed herein.

Bids on Local Purchases

"Suppliers desiring to bid on local purchases should address their request to be placed on appropriate bidders' lists to the Commanding General of the Army Area or Military District within which business is desired. Before requesting to be listed, consideration should be given to the fact that circumstances necessitating local procurement in sizable dollar volume usually demand immediate service or delivery and that the distribution of invitations must be limited to prospective bidders who are in a position to meet all requirements. Requests should be in letter form to facilitate duplication and distribution to installations, should identify the specific item, types of items or services to be offered and, to avoid possibility of being channeled back to the purchasing offices of the Technical Services,

should state that it is desired to bid on 'Local Purchases.'"

The addresses of the Commanding Generals of the Seven Armies are:

First Army, Fort Jay, Governors Island, N. Y.

Second Army, 37 Commerce St., Baltimore.

Third Army, Post Office Building, Atlanta 3.

Fourth Army, Fort Sam Houston, Tex.

Fifth Army, 1660 Hyde Park Blvd., Chicago, 15.

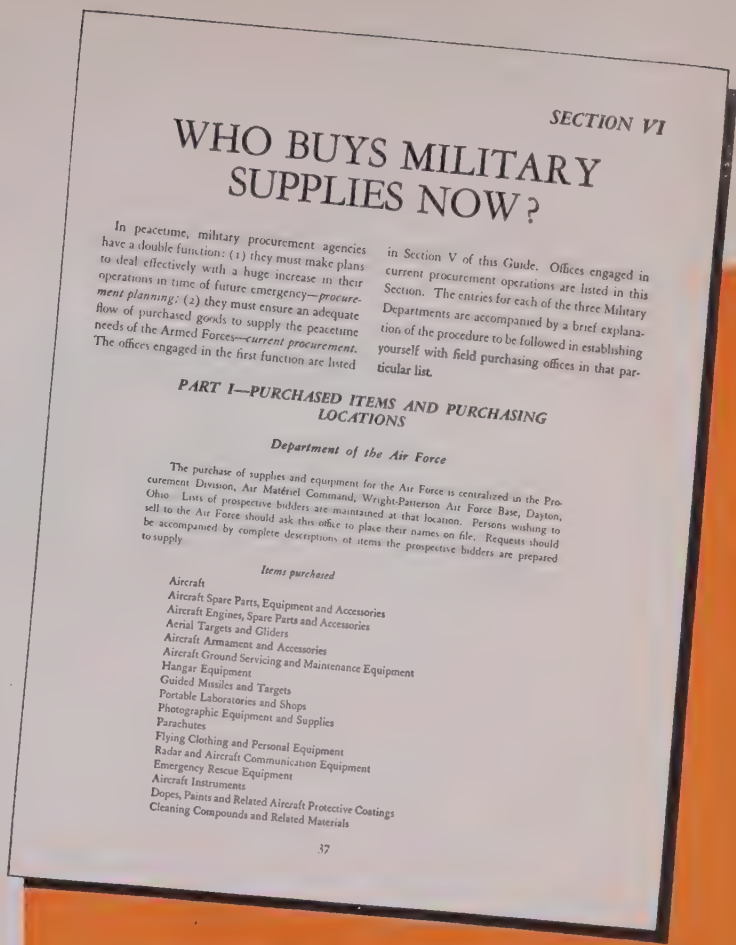
Sixth Army, Presidio of San Francisco, Calif.

Military District of Washington, The Pentagon, Washington, 25.

NAVY—Procurement for the Navy is divided between its bureaus and offices located in or near Washington and its field purchasing activities. The Washington bureaus procure, according to their various responsibilities, aeronautical items, ordnance items, educational services, ships, common-use items, heavyweight handling equipment, public utilities, permanent facilities, items for the Marine Corps, and research and development.

Ships and commissary stores, clothing, naval cloth, aviation supplies, general stores, ships parts, submarine supplies, construction equipment, electronic supplies, spare parts, tools and accessories peculiar to naval ordnance are all bought through field purchasing activities.

The addresses of all bureaus and field purchasing activities and other shore installations which can make purchases, together with the procurement responsibility of each, are listed in the Navy Department's pamphlet, "Selling to the Navy." It may be bought from the Superintendent of Documents, U. S. Government Printing Office. In addition, the pamphlet gives complete details of Navy Procurement including discussions of contracts, inspections, and methods of making payment.



SECTION VI

WHO BUYS MILITARY SUPPLIES NOW?

In peacetime, military procurement agencies have a double function: (1) they must make plans to deal effectively with a huge increase in their operations in time of future emergency—*procurement planning;* (2) they must ensure an adequate flow of purchased goods to supply the peacetime needs of the Armed Forces—*current procurement.* The offices engaged in the first function are listed in Section V of this Guide. Offices engaged in current procurement operations are listed in this Section. The entries for each of the three Military Departments are accompanied by a brief explanation of the procedure to be followed in establishing yourself with field purchasing offices in that particular list.

PART I—PURCHASED ITEMS AND PURCHASING LOCATIONS

Department of the Air Force

The purchase of supplies and equipment for the Air Force is centralized in the Procurement Division, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio. Lists of prospective bidders are maintained at that location. Persons wishing to sell to the Air Force should ask this office to place their names on file. Requests should be accompanied by complete descriptions of items the prospective bidders are prepared to supply.

Items purchased

Aircraft
Aircraft Spare Parts, Equipment and Accessories
Aircraft Engines, Spare Parts and Accessories
Aerial Targets and Gliders
Aircraft Armament and Accessories
Aircraft Ground Servicing and Maintenance Equipment
Hangar Equipment
Guided Missiles and Targets
Portable Laboratories and Shops
Photographic Equipment and Supplies
Parachutes
Flying Clothing and Personal Equipment
Radar and Aircraft Communication Equipment
Emergency Rescue Equipment
Aircraft Instruments
Dopes, Paints and Related Aircraft Protective Coatings
Cleaning Compounds and Related Materials

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A TYPICAL page from the booklet "Military Procurement," designed to tell industry how and where supplies and equipment for the armed services are purchased.

Purchases by the Air Force

AIR FORCE—All purchases of stock utilized by all Air Force installations, procurement of aircraft and accessories, contracting for research and development projects, except electronics ground equipment, and contracting for personal. specialized or technical services are functions of the Procurement Div., Headquarters, Air Material Command, Wright-Patterson Air Force Base, Dayton.

The Commanding General at independent commands may make awards, execute and approve contracts in approved forms involving sums not to exceed $50,000.

Local purchases, under prescribed conditions, can be made by Air Force installations, depots, bases or other commands. The list of items which can be bought locally is diverse. Detailed information on all phases of Air Force procurement may be obtained by writing the Contract Relations Officer of the Air Materiel Command.

After checking the requirements of the military departments, you may find that you cannot hope to obtain a prime contract. This is no reason for giving up the ship or the idea of supplying some of the ship's parts or equipment. The possibility remains that you can do a lucrative business as a subcontractor.

You can lose little by contacting prime contractors for whom you may be able to produce components. Your best chance to obtain rapidly the names of firms receiving contracts from the Armed Forces so you may contact them is through trade journals and trade associations. Valuable help may be obtained from the Contract Assistance Div. of the Department of Commerce.

If you made components for prime contractors during the war, get in touch with them and bring them up to date on your plant capacity and your ability to produce.

Many factors could change the military procurement picture rapidly. Among those bound to effect a gradual change are such Munitions Board undertakings as further procurement assignments, a single, streamlined system of cataloging military supplies and equipment, standardization of specifications and completion of the Armed Services Procurement Regulation, to name a few. All these, however, as the late Rudyard Kipling was fond of saying, are another story.

f.o.b. mill

The switch to f.o.b. mill prices for steel has unleashed one of the bitterest and most confusing economic conflicts of the century. Wading through a mass of confusing claim and counterclaim, the author appraises steel pricing systems from a practical viewpoint. Is the confusion due to f.o.b. mill's natural unworkableness, or does it result from a misapplication and misunderstanding of the new system? Here are the facts on f.o.b. mill.

By D. I. BROWN
Chicago Regional Editor,
THE IRON AGE

Pricing systems are inherently delicate. However, the American system of multiple basing point selling as used in the steel industry proved over the years to be exceptionally hearty. Although more intricate than many other pricing systems, it was very flexible. Government economists referred to it as the "ingenious system." Many attacks had been made on it without apparent impairing, to any great extent, of its vigor or general health.

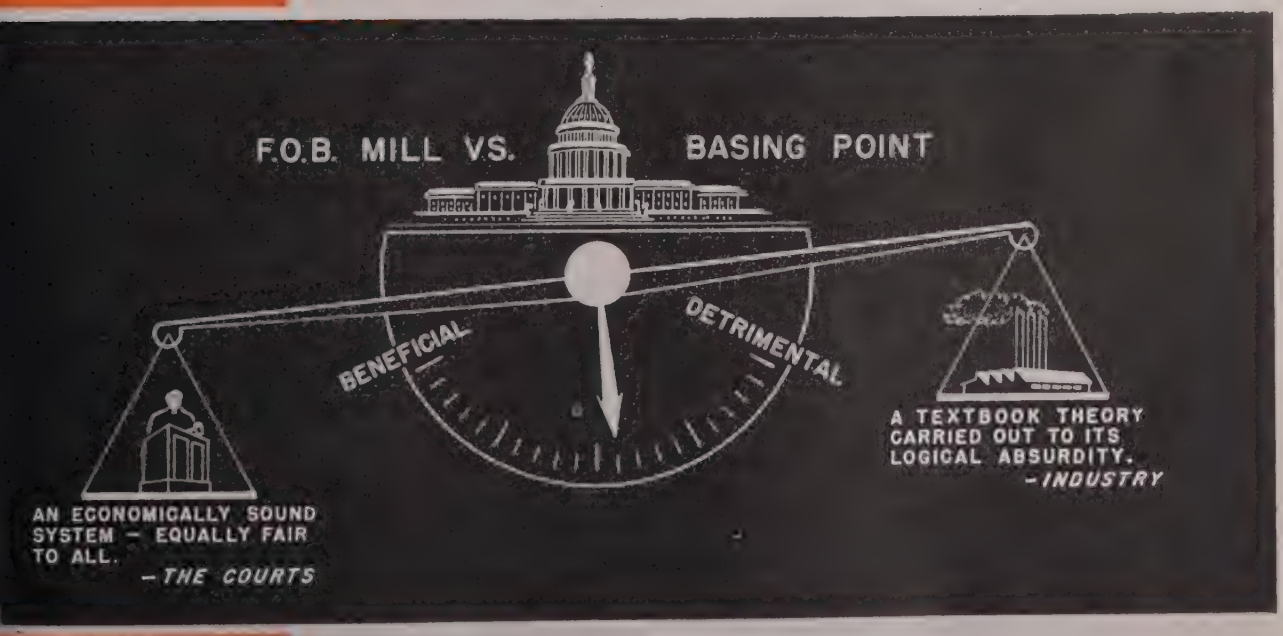
At 24 years of age the multiple basing point system appeared until last July to be robust and healthy and destined to live a long, full life.

But now the healthful glow is gone. Indeed, its healthy appearance seems to have been but skin deep. Inside the system was undermined, condemned and diseased—living on borrowed time.

It's all over now, the end was unexpected and quick. Grief is everywhere. Industry wants Congress to revive its fallen champion. Congress despatched its specialist, Senator Capehart, to investigate the matter. So far the senator doesn't quite know whether to perform an autopsy, do a little surgery or just recommend that Congress get out the pulmotors and bring the shining knight back to life.

In the meantime, steelmen are using the only substitute they could find. F.o.b. mill was shoved into the breach for lack of anything better. The steel industry doesn't like rigid f.o.b. mill. They aren't sure how the substitute will behave. They can't control it. Steel consumers like f.o.b. mill even less. They say it has already cost them a pile of dough. The mourners aren't sure that Congress will be able to perform the miracle they ask. As an alternative they are hoping that possibly Congress can remodel f.o.b. mill and develop a suitable replacement. But first they would like someone to tell them all about this character, and quick! This time they want to be told in plain, everyday English that anybody can understand.

One of the major stumbling blocks between government agencies and business has been the lack of agreement on the definition of such things as *price, competition, conspiracy, et al.* Prior to the court's cement decision



such arguments were often of academic nature. When economic theories became law, and steel went f.o.b., the issue quickly became one of vital importance—survival!

Some steel executives have naturally concluded that, because they have used multiple basing point systems or delivered prices in doing business for the past half century, this in itself proves that such methods of doing business are the best, the fairest, and therefore above reproach. Many leading economists and jurists, plus certain members of the FTC, do not and never have considered the basing point practice as anything but an unfair restraint of trade. Since the Supreme Court's decision businessmen have been putting up a lot of arguments to the contrary. It's an old sore.

Businessmen have confessed that they don't understand the new concept. The FTC itself is in violent disagreement over the Supreme Court's interpretation as opined in the cement case. Generally all hell has broken loose over a subject as fundamental to business as is price itself. That confusion exists is not at all surprising.

Carlisle's damning of "the dismal science" was because it was remote from his own experience. He could not understand it and was uncomfortable with its abstraction. Capehart's lame duck congressional committee investigation so far has only proved that Carlisle has plenty of company.

The confusion became so great that late in November the senator himself urged a recess in hearings until the committee could meet with FTC and compare notes. As a result of that meeting held last Dec. 7 two peace makers were appointed, William Simon for the Committee, and Robert Dawkins for the Commission. It remains to be seen what agreement can be reached, if any.

Why are we in such a mess? How did f.o.b. mill get started? It's not new, although many are laboring under that impression. F.o.b. mill is akin to the New Look; they were both in vogue prior to 1900. In view of present events a little history is not only interesting, it's mandatory to properly evaluate the factors in the present conflict.

Best available records indicate that prior to 1880 steel was sold exclusively on an f.o.b. mill basis. Carnegie Steel Co. first introduced the Pittsburgh plus system in the spring of 1880 through the Beam Assn. which consisted of the Passaic Rolling Mills, New Jersey Steel & Iron Co., Phoenix Iron Co., and Carnegie.

The Pittsburgh plus case was not brought into court until 1921. Carnegie itself testified during the litigation that it is impossible to maintain uniform prices without a basing point. They tried in 1909 but were unsuccessful and quickly reverted to Pittsburgh plus. Steel billets as early as 1896 were sold on basing points. In 1900 Charles M. Schwab, then with Carnegie, swung plates over to this system.

In the same year a number of sheet and tin mills were absorbed by American Sheet Steel Co. and American Tin Plate Co. Mergers blossomed forth all over. Other industries started using the basing point system. Almost at once all sheet producing mills adopted Pittsburgh plus. Prior to this sheets had been strictly f.o.b. This move by sheet makers is noteworthy because it was the first instance of the use of a nonproducing basing point. There were at this time no mills making sheets or tin plate in Pittsburgh or its switching area. Ohio mills produced more sheets than those in Pennsylvania.

This fact, recalled later by the prosecution in the Pittsburgh plus case, hurt the U. S. Steel Corp.'s cause for the defense had implied that the simple convenience and "naturalness" of the plan stemmed from the fact that Pittsburgh was the great center of steel from which most steel products were actually shipped when the Pittsburgh basing point system came into use.

We will skip the "Gary dinners" and formal agreements, pools, etc., through which many steel prices were fixed from 1901 to 1911. Pittsburgh plus emerged perfected in 1912 to govern the selling of the steel industry until it was outlawed in 1924. The multiple basing point system used by the industry from 1924 until last July was simply a modification of the Pittsburgh plus system. Both are delivered price systems of selling. How this system was maintained in face of the "cease and desist" order against Pittsburgh plus for 24 years makes interesting but somewhat ambiguous reading.

In September, 1917, the War Industries Board had established Chicago as a basing point equal to Pittsburgh. It was an emergency wartime measure. Chicago was equal to Pittsburgh minus the freight from Pittsburgh. Western fabricators not now having to pay the artificial "plus" received their steel much cheaper and hence expanded their plants and in general started to do a landoffice business free of competition from eastern fabricators. This for a time eliminated Pittsburgh plus practice as applied to mills in the Chicago district.

Ten months later at the height of World War I, Mr. Gary, president of U. S. Steel Corp., at a meeting of this board, of which he was a member, suggested Pittsburgh plus be restored. Members Brookings, chairman of the board, and Replogle thought it a good idea. The rest of the board also agreed. Within a week Illinois Steel Co. in Chicago, a U. S. Steel subsidiary, raised prices to the old Pittsburgh plus rate and independent mills immediately followed.

At once steel users started to howl. The Western Assn. of Rolled Steel Consumers for

TABLE I

Do Steel Consumers Prefer Basing Point or F.o.b. Mill Prices?

Results of a survey conducted by THE IRON AGE. Data below are based on returns from 1726 plants received up to press time. Final tabulations will be published early this year.

No. of Plants	Didn't Indicate Preference	Favor Basing Point	Favor F.O.B.
With less than 100 workers..	148—16.4%	641—71%	111
With 100 to 250 workers.....	49—13.9%	267—74%	47
With 250 to 500 workers.....	22— 9.3%	192—82%	21
With over 500 workers.....	17— 7.4%	195—86%	16
Totals	236	1,295	195

the Abolition of Pittsburgh Plus was formed in January, 1919, and from then on Pittsburgh plus was doomed. The restoration of "plus" to the Chicago mill price added $5.40 a ton the day it went into effect. Later, on Dec. 1, 1920, freight rates went up 40 pct which meant a total phantom freight of $7.60 and midwesterners refused to sit still any longer. On July 21, 1924, the Corporation was ordered to "cease and desist" from Pittsburgh plus. Much to the FTC's surprise the Corporation did not contest the order.

It should be remembered that from 1911 to 1920, U. S. Steel Corp. was engaged in the greatest lawsuit in the history of the United States courts. It was fighting for its life, having been charged by the commission to have violated sections 1 and 2 of the antitrust act of 1890—a charge involving monopoly and restraint of trade. The Pittsburgh plus policy was not referred to at any time during this complaint. About one year after the Corporation defeated the dissolution suit, the Pittsburgh plus complaint was issued by the FTC. In this suit the Corporation was accused of violating both section 2 of the Clayton Act, forbidding discrimination, and section 5 of the Federal Trades Act, forbidding unfair methods of competition.

More recent history concerning the long battle on basing point pricing systems has been well documented by Mr. Simon, general counsel for the Capehart Committee. Three times the FTC has tried to get Congress to outlaw the delivered price system. The last time was in 1941 during the hearings of the Temporary National Economic Committee headed by Senator O'Mahoney. His committee recommended that Congress outlaw basing point systems. Congress did not see fit to do so.

Such has been the long legal battle over the pricing policy which has now been outlawed, but which by their testimony before the Capehart Committee, a majority of businessmen in this country want to have returned. Or if not returned, they want the existing law modified in a fashion which they feel will permit them to compete wherever and whenever they choose.

Producers want the choice of absorbing freight, if they care to, in order to enter market areas remote from their own mills, or in the backyard of a competitor's mill. Such a system would permit "cutthroat competition," some FTC members believe. Not only that, it would encourage "dumping," an act much feared and detested by government economists.

Why did the steel industry go back to the 19th century pricing system? Herbert A. Bergson, assistant attorney general, told the Capehart Committee on Nov. 10 that the demand by industry and business for legislation to legalize freight absorption is decidedly premature. In his view, existing pricing methods (multiple base point) may be continued without fear of any prosecution under the FTC act. This type of reasoning didn't make sense to Benjamin Fairless. It doesn't ring true to other industrialists.

Lynn C. Paulson, assistant trial counsel for FTC, backed up Mr. Bergson. He said businessmen "are more frightened than they need be. . . . The Supreme Court has not yet passed on the legality of freight absorption. . . . I have not yet seen the need for proceeding upon an individual basis against freight absorption in order to destroy price fixing. I think there is danger to the competitive system in placing too many restrictions on competing."

This is fine and heartening talk, but industrialists say "this ain't the way we heard it." J. L. Block, vice-president of Inland Steel Co., before the Capehart Committee on Nov. 16, in discussing the multiple basing point system of selling said, "In the opinion of our attorneys this practice became illegal when the cement case decision was handed down. Our lawyers knew that in the preponderance of our sales to manufacturers and jobbers our customers relied on us to serve them constantly and not periodically, and therefore advised us that we could no longer follow our prior policy of absorbing freight (or depressing our realized prices) to meet competition without being in violation of the law."

From a practical standpoint, the steel industry, which has publicly said they are willing to go back to the old system, has been accused of

TABLE II

Typical Rail Carload Rates on Finished Iron and Steel (Cents per 100 lb)

EFFECTIVE DATE:	5-29-30	3-28-38	1-1-47	5-6-48
				Present Rates
RAILROAD MILES		10% Increase	20% Increase	30% Increase
5	3	3¼	4	5¼
10	3¾	4¼	5	6½
15	4½	5	6	8
20	5¾	6	7	9
25	6	6½	8	10½
30	6½	7	8½	11
35	7¼	8	9½	12½
40	8	9	11	14
45	8½	9½	11	14
50	9¼	10	12	16
55	10	11	13	17
60	10½	12	14	18
65	11¼	12	14	18
70	12	13	16	21
75	12½	14	17	22
80	13¼	15	18	23
85	14	15	18	23
90	14½	16	19	25
95	15¼	17	20	26
100	16	18	22	29
105	16½	18	22	29
110	17	19	23	30
150	19	21	25	33
200	21½	24	29	38
250	24	26	31	40
300	26½	29	35	46
400	31	34	41	53
500	35	39	47	61
600	38	42	50	65

Note: These rates apply between points in official railroad territory comprising generally that area lying east of the Mississippi River and north of the Ohio and Potomac Rivers, except that they do not apply between points in Illinois or Wisconsin. Rates within Illinois Territory, which includes the state of Illinois, Chicago Switching District, points in Indiana, Mississippi River points in Iowa and Missouri, and points in Southern Wisconsin are on a different and somewhat lower basis.

FIG. 1—Natural market areas of principle makers of cold rolled sheets based on the application of rigid f.o.b. mill selling are illustrated in this map. Freight rate advantage areas are shown in heavy black lines. Further breakdown is achieved by using current base prices plus freight to arrive at market areas. The natural market areas for major cold rolled sheet makers are superimposed over theoretical freight rate areas. Locations of major mills are shown as heavy red dots; minor mills not used in geographical breaddown are shown by black triangles. Sheet mills east of Youngstown are not included in this study. Map adopted from study of Chicago Assn. of Commerce and Industry.

having an ulterior motive in switching to f.o.b. mill. During the present steel shortage they stood little chance of losing any revenue. Some mills have even increased their revenues simply because their former freight absorption amounted to more than the phantom freight. Why not switch to f.o.b. mill? Let the consumers carry the battle to Congress. This is certainly less awkward. If this was actually one of the reasons they went f.o.b. the hunch certainly paid off.

Never since the western consumers banded together to get rid of Pittsburgh plus has a consumer group teamed up and argued so hard for a common cause. The odd part of it is that they are now cheering for a system not wholly unlike the one they fought 20 years ago.

Moves Caused by F.O.B. Mill

Much testimony and print has appeared concerning the effect of f.o.b. mill prices on many different kinds of business. One popular claim is that steel consumers will immediately be forced to move into steel producing centers. These accounts allege that they must do so or perish. This type of thinking is premature. Some such moves have been made. However, many of these were planned before f.o.b. mill, and others came about for reasons not fully connected with the court decision. Increasing freight rates since the war have been causing all steel sellers to restrict their market areas and this, in some cases, has caused consumers to shift their plants or production. Very likely this freight restriction would have slowly accomplished some of the results f.o.b. mill is supposed to accomplish, except freight absorption could have been practiced in the cases where the seller wished to do so.

One of the major headaches facing consumers is that all products can seldom be supplied by any one steel producer. Steel supply then is a composite thing. It does not lend itself to theoretical assumption. It is a very real and practical problem.

Another factor is that consumers usually like to have more than one source of supply for each major item. To move into an area across the street from a certain mill precludes the advantage the consumer might have if he were equidistantly located from two or more mills. Inbound freight on raw materials is but part of the cost of any manufactured article. Proximity to a manufacturer's market, labor conditions, power cost, etc., are equally important. All these factors must then be considered, along with f.o.b. mill, in weighing whether or not to move a plant.

Results of a survey by THE IRON AGE on the f.o.b. mill question are shown in table I. Much has been heard about small plants being affected more than large ones. It will be noticed in table I that a greater percentage of small plants didn't even vote on the question. In the survey, steel buyers were asked to state their preference for either f.o.b. mill prices or the former basing point prices. At press time only partial returns were in but it is felt that the results shown are indicative of the final result.

Overall, business men say they can't intelligently make decisions about plant location until f.o.b. mill and all its ramifications have been clarified. It appears that this clarification in the form of a clearly marked legal route is essential before such moves can be considered in any important volume.

How long will clarification take? Walter Woodin, associate general counsel of the FTC, has said that complete definition and interpretation in the cement decision is impossible! He has inferred that legislation on basing point pricing would make price fixing conspiracies easier to operate and more difficult to break up. Should this be true speedy remedial legislation by Congress may be nothing but a forlorn hope.

Responsible management executives of large and small industries of all types have testified before the Capehart Committee that f.o.b. mill precludes competition, raises prices, creates local monopoly and does practically everything opposite to what the economists said it should do. If f.o.b. mill was designed to help small business and curb large organizations, the testimony given so far clearly indicates that this has not been true. Testimony by members of the National Small Businessmen's Assn. cited their loss in dollars and cents. How could this happen?

The FTC and other proponents for f.o.b. mill have always contended that the new system, because it is economically sound, should actually make the delivered cost of steel cheaper. Why doesn't it then? This group believes that one reason for this is that f.o.b. mill has been misapplied.

Change Over to F.O.B. Mill

In the first place, this group says, the steel industry forgot something when it changed over to f.o.b. mill. They forgot that in their former delivered prices, freight had been included. When they changed to f.o.b. mill, this overall average freight factor should have been subtracted from the old price, and the balance then declared to be the new mill price. Had they done this steel would immediately have become cheaper to all customers nearby. Consumers further away would have paid differentials, either below or above the former delivered price depending on distance from the mill. More simply stated, those customers to whom the mills were absorbing freight, pay more; those to whom the mills were collecting phantom freight, pay less.

The way it was worked, however, didn't make steel cheaper to anyone. Whether the producers did this intentionally or not is irrelevant. What is important, the f.o.b. mill adherents say, is that the producers so improperly applied f.o.b. mill pricing systems that the resulting confusion has made it impossible for consumers to evaluate the true effects or worth of the system itself. Immediately after adopting f.o.b. mill the steel industry issued a general price increase. This action served to further confuse things.

That far away consumers from the mills were hurt most, is simply due to their location. The very nature of f.o.b. mill practice establishes definite market areas. It means steel must be

purchased from the nearest source. It means a minimum or no cross hauling at all. It means a reshuffling of customers. And until this is done the basic requirements of this system will not have been satisfied. It doesn't mean, however, that a consumer in the switching area of his supplier should pay more for steel under f.o.b. mill than under the old system.

Market Areas Compared

In the effort to fathom what the f.o.b. mill adherents are talking about, it is necessary to consult the new distribution areas now formed as the result of going f.o.b. mill. To make sense out of it, it is necessary to compare market areas on a single product basis. Fig. 1 is a map of the freight rate advantage areas of the principal midwestern mills producing cold rolled sheets. The Pittsburgh market is not included in this study. Geographical natural areas or markets for each producing point are determined primarily by transportation costs from the point of manufacture to the buyer. Such maps are theoretical in many important respects. One is that it assumes that all base prices are the same for cold rolled sheets at each and every plant. However, it is basically correct in that it shows the extent of natural market areas as governed by carload freight rates alone (heavy black lines on map). Upon correcting the map by using current base prices charged by the mills involved, the natural market areas change appreciably as shown by the cross hatched areas. Note Detroit's restricted actual market area, compared with its normal freight rate advantage area.

With but one important steel producer of cold rolled sheets in the Detroit area, it would be expected that its normal market area would be small. This mill cannot possibly furnish all the sheets needed for the auto makers and other manufacturers in the immediate Detroit district. Under a strict f.o.b. mill system the other mills can only get into Detroit by cutting their base price, or by Detroit customers paying more for sheets made in other areas. It will be noticed from the map that Cleveland would have to make a smaller cut to get into Detroit than would Chicago. The only trouble with this is that Chicago is one of Detroit's chief sources of automotive sheets. The Chicago mills are still shipping into Detroit, but the Chicago sheets cost a little more to the consumer than do sheets produced in Detroit.

Proceeding again on the basic theory of the f.o.b. mill price, this would mean in ordinary times that if Chicago wanted to service Detroit it would have to establish a lower base price to enable them to go into Detroit and lay down sheets at a delivered cost competitive with that of Great Lakes Steel Co.

Here is where Chicago steel makers say f.o.b. is unfair. Why should they be expected to take a lower mill net from all their customers just to service Detroit? Under f.o.b., a mill can't have different mill nets. The freight rate from Gary to Detroit is 44¢ per 100 lb. Great Lakes' base price is $4.20, Chicago's is $4.00 a 100 lb. For Chicago to lay sheets down in Detroit proper at Great Lakes' price, Chicago mills would have to cut their base price 24¢ a 100 lb less the Detroit switching charge. This would mean that their mill net on cold rolled sheets would be about $8.00 a ton less than Great Lakes'. This might be OK except Chicago mills insist their manufacturing costs are not that much less than Detroit's, in fact costs in the Chicago area may be higher.

Of course, the instant Chicago mills dropped their mill net 24¢ or less, their market area would widen out. They could ship further into Indiana and move Middletown's area back by about 80 miles, or half the distance of the full mileage that 24¢ will buy in this mileage bracket. Their reach beyond St. Louis would increase. This, Chicago mills say, may be of little benefit. The mills want to sell auto sheets in the big market. They have tooled up to do so.

Invasion of Middletown's area could probably not be tolerated by the producer there. It might choose to meet such competition by changing its base price. Should it meet Chicago's competition by also dropping its price 24¢, its market area would return to that shown in the map as far as Chicago competition is concerned. But in so doing, Middletown would move north right into Detroit. Why? Because the freight from Middletown to Detroit is also 44¢ a 100 lb. If the first invasion of Detroit by Chicago makers didn't cause Great Lakes to cut its prices, the second one from the south probably would.

Cleveland Market Areas

At the same time, Cleveland can get into the Detroit market via water almost at will. This back door is wide open not only to Cleveland but to Chicago and even to Buffalo. Cleveland steelmakers might not be thinking so much about Detroit if the above situation materialized. They would probably be more concerned with their own backyard. If Middletown dropped its mill net to $3.76 to keep Chicago out of southern Indiana, and Ohio, Armco would not only find itself competitive in Detroit, but Armco would also have extended its market area a full 12¢ worth of rail mileage beyond Marion, O. into Cleveland's natural freight advantage area.

There are two ways to beat the f.o.b. mill system—trucks and water shipment. Both are legal. By using trucks which charge 33¢ per 100 lb, Gary shipments can now get into Detroit at $4.33 against Great Lakes' estimated $4.25. The extra 5¢ over Detroit's base is about the average truck charge the customer pays to have the sheets delivered by a contract hauler. Chicago is still a few cents high but this difference can be ironed out.

Then there is the water route available in navigable months. This is not as cheap as it might appear because of terminal charges at Detroit. Using common water carrier rates and adding the expense of rail delivery at the Detroit end, plus other incidental terminal charges, it costs 25¢ per 100 lb to get steel from Chicago to Detroit customers. This does not include loading expense at Chicago. Thus, today it is possible via water to meet Great Lakes' delivered price of $4.25 in Detroit out of Gary or Chicago mills. However, contract water rates are much cheaper. Steel producers who own their own

boats can cut these delivery costs still further.

Steel executives pointed out to THE IRON AGE that merely lowering the Chicago base price in order to be competitive in Detroit won't really accomplish anything, no matter how they ship. If Great Lakes found this competition too stiff they could lower their base and the thing would be right back where it started. "Ah," say f.o.b. mill adherents, "This is what we are talking about. This is true competition. Doesn't this fight for business actually lower steel prices?" It might, but again it might not.

Breakeven Operating Rates

The industry has estimated that in 1939-40 the breakeven operating rate was about 42 to 59 pct. Now they say it's close to 80 pct. It is obvious they will reach a minimum base price at which it is no longer good business to try to ship steel out of their normal geographic freight advantage area. If the lack of this outlet means their operations slip below 80 pct they say they will then be forced to raise the base price to all customers to whom they can still ship. The mills claim that if they don't do this they can't make a profit at the lower operating rates. This increases steel costs to everybody buying from such a mill.

Here is one of the most valid arguments the industry can advance in favor of a return to a multiple base point system of selling. They can prove that under the old system they could cut a price into a few special areas and still serve all others on the old price, thereby holding their operations above the breakeven level. However, this reasoning is somewhat theoretical too. In the past, cuts in price to a certain special locality have usually leaked out and other customers elsewhere have put on pressure and received a similar discount.

One fact remains clear. The f.o.b. mill system has yet to be tested in a stiff competitive market. The mills can't actually back up all their dire prophecies yet. Some of their contentions are based on solid reasoning, but a lot of it is guess work.

The configuration of market areas shown in fig. 1 is probably not correct for the reason that the present f.o.b. mill prices were erroneously set up. Steel executives will for the most part agree to this. They admit that the present prices were not set up on their own merits as to actual producing costs, but were adopted in direct relation to what the old basing point price had been. They admit that the cost of steelmaking of any one of the hundreds of single products made by the industry could not possibly be the same in every mill. They also point out that for this reason marketing would become so completely complicated under f.o.b. as to be totally unworkable. Market areas such as shown in fig. 1 must of necessity be set up on an individual product breakdown for every mill. Some mills make practically all important products while others specialize in but a few.

To predict the future precise marketing areas of each mill is not possible. However, it is possible to ascertain quite accurately from the present geographic market areas for individual steel mill products what might happen. From fig. 1 it will be seen that freight-wise the Chicago steelmakers market in cold rolled sheets should only extend over the top half of the state of Illinois. However, the lower base price of Chicago steelmakers, $4.00 compared with $4.70, enables these mills to sell in St. Louis at lower prices than Granite City is charging. How then can Granite City sell its sheets? The answer is simply that demand in this area at present is so much greater than supply that customers will buy anybody's sheets at almost any price. Under such circumstances Chicago could ostensibly raise their base price 32¢ plus the switching charge from Granite City to St. Louis and still sell competitively in St. Louis proper. However, should they do this, their reach into the state of Michigan would immediately shrink and Armco at Middletown, Ohio, would automatically push further north into the state of Indiana, provided neither of these companies changed their present price.

Granite City Markets

Let's assume that all at once demand slackened to the extent that cold rolled sheet users in St. Louis could get satisfactory delivery from Chicago mills. Immediately Granite City would have to lower its base price or it wouldn't get many orders. If steelmaking costs at Granite City permit them to stay in business at a lower base price, at, for instance, Chicago's present base price, they would then have a moderately good area in which to operate. This area would conform to the freight advantage areas shown in heavy black lines in fig. 1. If the present $4.70 base is rock bottom for Granite City and $4.00 is an equitable base at Chicago, then in normal times Granite City would not last long in the cold rolled sheet market.

This same procedure can be applied to any area on the map, and by using the freight rate data in table II definite marketing areas, as determined by rates alone, can be obtained on every steel mill product. Fig. 2 was constructed in this manner and is not corrected for any difference in price. Actual market areas are a direct function of the rates and the mill price. A mill price under f.o.b. can't be fictitious, it has to be based on steelmaking costs. Costs are the floor. Further, the margin of profit must be kept as slim as possible and still allow a company to stay in business, as the lower the total price the wider the market area.

Even in this comparison there are factors which cannot be evaluated. Like all good things there is a sleeper in the new system. The total price of steel is not simply just the base price, but base plus extras. Base price amounts roughly to only 65 to 80 pct of the whole price on hot rolled sheets, depending on gage, size, quality, specifications, etc. On cold rolled sheets, however, base price represents 90 to 99 pct of the entire base price depending on exactly the kind of a sheet ordered.

At one time all mills charged identical extras. This is no longer true, particularly on hot rolled sheets and strip. Any comparison, similar to fig. 1 can only be correct within the tolerance of the various different extras charged by the actual mills involved. For all practical pur-

poses, geographic market areas for each steel mill making cold rolled sheets can be correctly defined simply by using the base prices used in fig. 1, for extras on this product are such a small part of the total price.

Thus, predictions of how f.o.b. mill should eventually work is fraught with danger. In some states irregular or special freight rates exist in special areas. Indiana and Illinois have a special steel product grouping rate on certain movements which differ from the rest of the Eastern Official Territory east of the Ohio-Indiana line. Water transportation is another factor which in many cases must be considered. Overall, however, steel freight rates as shown in table II govern most of the other factors. Freight rates are the only constant in the whole equation. True, they may go up, but they usually advance on a consistent percentage basis.

In all the confused and lengthy pronouncements about f.o.b. mill nobody has been specific enough to talk freight rates. These charges are the nub of the whole thing. It's impossible to evaluate fairly f.o.b. mill or multiple basing point systems without consulting freight rate tables.

In either system both consumer and producer are vitally affected. Under the former freight equalization, or absorption, system actual freight costs which producers were willing to swallow determined their market. Prior to 1938 it was possible to ship 100 lb of finished steel in the short haul bracket (up to 110 miles) 55 to 75 miles for 10¢. Today 10¢ will only buy 25 to 52 miles (see table II).

A study of the table will reveal exactly why producers pulled out of far away areas even before f.o.b. mill. The increasing freight rates are not so bad in their general effect on costs but their geographic restrictions are murder! Pittsburgh is about 500 rail miles from Chicago. Under basing point system in the early 30's Pittsburgh mills spent 35¢ a 100 lb on shipments into Chicago if Chicago was a basing point for that particular product. Today it would cost them 61¢ a 100 lb if they were allowed to absorb. Suppose a Pittsburgh mill decided it could afford a maximum of 38¢ absorption to any customer. From the table it will be seen this restricts their outermost reach to 200 miles. Thus it is evident that even if multiple basing point systems were revived the old market areas have shrunk to approximately one third of their former radii, at points 500 to 600 miles away. This system works the same way under f.o.b. mill, except in reverse. The customer foots the freight bill.

Another 13 pct freight rate increase is pending. If this goes through, a producer's ability to do business outside his natural freight rate advantage will become even more remote. The only way to get out of these natural confines is to cut the base price so that the total delivery cost is competitive. The more rates go up the bigger the cuts in base price will be necessary to reach out X number of miles.

F.o.b. mill supporters believe that when the system shakes itself down, and the mills actually start charging a base price having a direct relationship to their steel producing costs, a measure of rationality in the steel industry will finally be achieved. Then, and only then, they say, can f.o.b. truly be assessed.

Steel executives interviewed by THE IRON AGE are not in agreement with any of these precepts. They claim the industry and the public were better off under the basing point system. They do agree that phantom freight should have been ruled out. They are against monopolies, conspiracies, etc., but they claim that these unfair restraints of trade can be eliminated without wrecking the basing point system of distribution or wrecking industry itself.

Steel producers are lamenting Pittsburgh's position. They contend the area is doomed to shrink as a steel center. It is not possible to pick up a steel plant and move it. If enough customers don't move into Pittsburgh's market, these predictions may come true. However, government economists in the FTC, and others, in favor of f.o.b. look at it in a somewhat different light.

If Pittsburgh is really a steel plus area then Pittsburgh steel prices could be cheaper than those, say, in Chicago. This is simply a matter of supply and demand. Should the Pittsburgh steelmakers choose to test this law they need only to lower their mill price and their market area would immediately extend itself. A drop of 30¢ a 100 lb in the Pittsburgh mill price of steel would add X number of miles to their natural marketing area according to the freight rates shown in table II. Youngstown, Weirton, Warren, etc., would be islands in a Pittsburgh sea.

How far they can thus expand what they consider their present unfairly restricted area demands upon the nearness of the competition, actual freight rates and the mills' producing cost. If they chose to thus broaden their natural market area, true demand and supply would automatically establish the new boundaries. If Pittsburgh can't expand its area enough to sell its entire productive capacity, because the cost of manufacture is too high, it means just one thing—too much steel capacity is located in Pittsburgh. This extra tonnage could be better manufactured elsewhere. This logic is just common sense. It's economics at the grass roots level. Many businessmen will agree that theoretically this is true, but they quickly add "Why wreck our entire complicated industrial machine for the sake of applying classic economic principles which are so obviously impractical?"

The multiple base point system of delivered prices held an umbrella over all producing areas whether they were high or low cost operations. Admittedly this is not an economic practice. Congress probably won't be asked to decide the question on the basis of economic theories, however. They will have to decide whether the cure is worse than the disease. They will have to somehow decide whether the alleged advantages of the new system are worth the risk of irreparable damage to our present heavy industrial localities.

Proponents of f.o.b. mill do not deny that the new system will bring changes. They even agree it might bring costly changes. They say that some mills in high cost producing areas

will be hurt. Some consumers will be hurt. Many plants may have to move. This they contend is the price of progress. They say further that it is a fair and just price.

Such is the paradox.

Senator Capehart late in November called on the FTC to help solve the dilemma. The FTC agreed to confer with a special Senate trade policies committee. FTC Chairman Freers' reply to Capehart was generally taken to indicate that the FTC was willing to discuss the possibility of legislation to clarify the basing point controversy. This does not jibe with Mr. Woodin's pronouncement. Dr. Corwin Edwards, director of the FTC Bureau of Economics, on Dec. 8 warned that exemptions to present laws, "would offer serious technical difficulties and might weaken the statutes."

One fact looms large and important. Any legislation permitting a seller to deviate, at his discretion, from straight f.o.b. mill pricing methods would completely nullify the FTC's present supervision of selling. For instance, the steel industry's plea for permission to absorb freight into market areas in which they would like to compete would, the lawyers insist, be the first crack in the foundation which could be widened and enlarged until the f.o.b. mill structure would fall apart. It would be somewhat analogous to the conclusion reached by some jurists in the old monopoly suits that certain corporations were monopolies, sure enough, but they were benevolent in their actions and were therefore OK. This type of reasoning wrecked FTC's trust-busting efforts then; a simple permit concerning freight absorption could just as easily wreck the whole f.o.b. mill price system now.

Industry has charged that f.o.b. mill erects local monopolies. This is true. This is true, however, only as long as the local king pin keeps its price in line. If Great Lakes decides to raise its price its market area automatically contracts. Its competition is now within 20 to 25¢ of being equal on cold rolled sheets right in Detroit. There are also markets like Flint which Great Lakes would like to service. To do so means that it, the local king pin, would be forced to cut its price 2¢ because of Cleveland competition. Being king pin in any local market has very definite limitations under f.o.b. These limitations are finite—cost of production and freight rates.

Thus, there is no mystery about f.o.b. mill itself. The only confusion left is that synthesized by the testimonies, some of which were incomplete or contrary to fact. A major decision, however, is still to be made. The facts are plain. The issue is clear. The major risks can be calculated. What remains to be done is to wipe the steam from our glasses so that we can see.

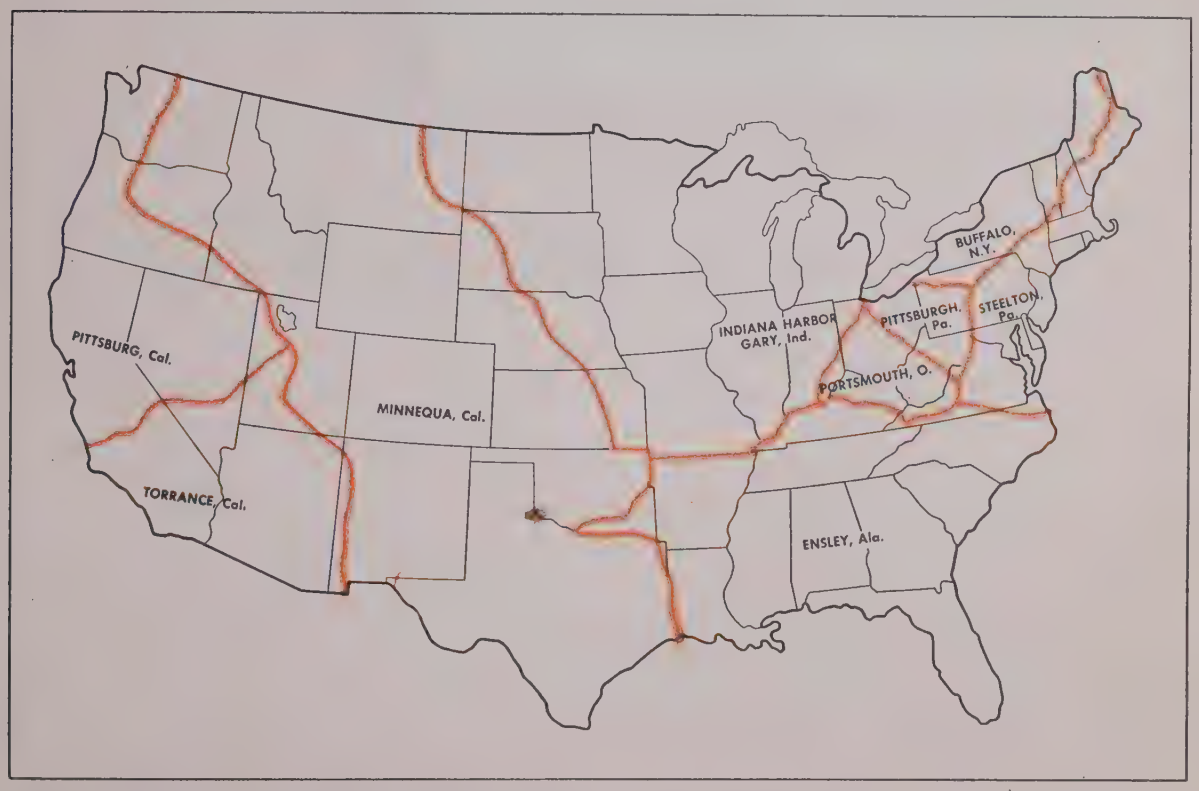


FIG. 2—Geographical freight rate map based on major producing mills, and latest carload rates. Market areas shown not corrected to base price. Producers shown are: Carnegie-Illinois Steel Corp., Inland Steel Co., Colorado Fuel & Iron Co., Republic Steel Corp., Bethlehem Steel Corp., Columbia Steel Co., Jones & Laughlin Steel Corp., Tennessee Coal & Iron Co., Wheeling Steel Corp.

steel

and the public

The paradox of an industry great in its technology and commercial enterprise, but burdened with no better than a mediocre public relations concept, is presented by the steel industry. Cause and effect of this unhappy situation are explored by the author and some simple but effective measures are suggested for bringing steel closer to the public.

By TOM CAMPBELL
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THE IRON AGE

The steel industry's righteous indignation at being kicked around for the past 16 years is not without merit. Its gripes over what it will get in the next 4 years will make sense. But all that does not change its position with Joe Public.

The gap between steel and the public is wider than ever. There is no reason to believe that it will be bridged in the near future. It could be—but the job might require a complete change in steel company public relations.

Neither the steel president nor the man on the street know each other, trust each other or are ready to believe each other. Governmental and administrative people and congressmen have a better understanding of how to reach Joe Public than does business. This despite the scads of money spent on public relations in recent years.

There is good reason why politicians, labor chiefs and administration men are able to get across their points—whether the points are right or not. They attack. They make news. They speak every-day language and they talk about things in which Joe Public is interested.

If these people were phonies—which they aren't; if it were assumed that they were always talking through their hat—which they aren't; even if this were true steel management has failed to do its part. These are not the views of any one person. They are the composite views of steel heads, steel public relations men, labor leaders, government people and the working press.

All point to the one simple weakness in the approach of steel to the public. Steel does not talk the same language, think the same things, show the same lusty warmth of living, nor does it succeed in making complex things understandable. That is the gist of interviews in the past 2 months on the question of steel and the public.

If the Lone Ranger can sell cereal he could sell the idea that steel people at the top are human and the company is made up of live stuff. So could "Stop the Music" and so could a lot of other people or programs. How about Jim Farley, J. Edgar Hoover, Ike Eisenhower or Bing Crosby. All

PRESS conferences like these pay off. It is the working press who translates the news to the public. When the heads of companies are there to answer the questions they show that they are interested in what they want the public to know. These gatherings are rugged. They always have been. They always will be. But they bring the press, the public and the headman together more than anything else. It is through them that "hot" ones are handled. Confidence is established and suspicion is eliminated. They make for good relations. They are not easy because hard questions require hard answers.

these people have one thing in common—everyone knows them and likes them. That's what a lot of PR's tell me in private. Maybe steel does need a popular mouthpiece. Other industries have gained by that method.

It seems naive to explain why humans well-known and liked make better hornblowers for a cause than anyone else. It seems simple. People spend most of their time eating, working and sleeping or variations of these. When they like someone they pay more attention to what that person says or does. Like the old axiom "Any friend of Joe's is a friend of mine" or something like that.

Some people in steel think courting the public is a waste of time. Or a waste of money. They don't have the "public be damned" attitude. They just think that steel is so far removed from Joe Public that anything they say or do won't bear fruit. Maybe they have a point.

Steel Remarks Have Been Negative

But others think that the 20 to 25 year olds (and older) are the ones who in the next 10 or 15 years will shape the destiny of steel. Now is the time to reach the public—and quick. Some of these persons believe that unless the public has a better understanding of what steel does, why it does it and what it hopes to do, nationalization of the industry in this country is not far away.

The steel industry—never thought of as having human traits—does not have a good historical record from a public relations angle. It vehemently fought the 8 hr day. It lost. It fought the elimination of Pittsburgh plus. It lost. It fought unions. It lost. It fought the New Deal tooth and nail. It lost.

It fought the drive early in the war for increased capacity. It lost and the government forced the issue with taxpayers money. It lost among its friends, when later it was obvious that the steel capacity added by governmental prodding is now the ace in the hole.

It misinterpreted the 1946 congressional elections. And in 1948 it was clear it and the public were far apart. The industry and its leaders have every right to believe they have been correct in their thinking. Maybe they were. But that has not been what Joe Public thinks. And what he thinks is more important to the industry in years to come than ever before in industrial history. If by misunderstanding or by lack of effort on the part of its trustees this basic industry becomes socialized it means the end of something.

Steel people in high places—when they did talk—have usually been against something. Their reasons have been good and logical in a lot of cases. But bucking worldwide trends at times gives nothing but a bloody head.

The greatest example of this was the recent tirade over a small increase in semifinished steel prices last February. The yammering about it was nation-wide. It was a reflection not of the rise itself or its amount; it was a horrifying example of how far away steel has drifted from the working press and the man on the street.

When things get tough—"Let George do it." George in the steel industry is often the American Iron & Steel Institute. The buck for bad relations has been passed to the AISI so many times it isn't even funny anymore. A few ghastly mistakes which have been committed under the name of the institute—forced on it by its board of directors—are just as well forgotten.

The American Iron & Steel Institute is one of the best of its kind of organizations in the world—when viewed in light of its purpose. It is first and last a statistical gathering organization. It tells the history of iron and steel in figures. It furnishes data for market research that is invaluable. Its books on specifications are the last

word in helping buyers pick the right steel.

But it is not human, it cannot be made into a person. Any attempt to do it has been, and will be, a failure. It is not fair to make it a fall guy in the spoken and unspoken antisteel feelings among the public politicians and the working press.

Releases of the AISI usually never get anywhere but on the financial page of the papers. Sometimes its name is on the front page but not often. And when it is some politician who speaks simply and clearly in language generally understood—but not always factual and sometimes downright lies—is jabbing in the needle. No, the AISI is not to blame for poor public relations in steel.

How about the PR's—public relations directors of various steel firms. They are no worse or no better than most public relations men. With the material they have to work with at times their job is little short of miraculous. But when things go wrong—brother look out. They get brickbats from their bosses, the press, their wives, congressmen, friends and close associates.

If a lot of PR's had their way things would be different. They do quite a lot of muttering in their beards. Often, office routine or circumstance forces them to be a carbon copy of Mr. Big—or his ideas. Many have so lost the feel of the "common" touch that they find it hard to think any differently than the heads of their companies—and that is bad.

Public relations is a profession—for those who believe in it and want it to work. But for some reason or other the working press is either openly or silently suspicious of public relations men as a group—but not always as a person. It all adds up, soon or later, to a personal or human angle. The PR man left to his own devices and allowed to do a job which he thinks he knows a lot more about than any one else, might solve a lot of steel's public relations problems over night. But it isn't that simple.

The rub often comes in steel because the bossman in many cases doesn't give his PR a break. The public relations fellow could rear up on his hind legs and say "the hell with it—here is the way it should be done." But as a rule this is only done in success stories or when no one else is listening. Besides PR's have to eat too. And they must believe they are a success in their work or they will get an inferiority complex. And they don't like those things. So they just get ulcers.

A steel mogul will never tell his first helper how to make steel—he might be tossed into the ladle along with the coal or the manganese. He doesn't tell his sales chief how to sell very often either. But chances are he could—if he came up the hard way—both make and sell steel. But he wants none of it because the good book says to delegate authority or go nuts. But public relations. Ah, that is another matter.

Knowing little or nothing about the temper and the thinking of Mary Jones or Joe Public many of our upstairs steel people insist on being their own public relations man. They do it by vetoing or changing for various reasons (political, legal, educational, pure cussedness or just because they think papa knows best) the best laid plans of mice and men.

Occasionally they face the gentlemen of the press. But most of their stuff comes out in mimiographed form and a lot of it reaches the circular file (waste basket). Sometimes Joe Public sees it if he happens to accidentally turn to the financial page.

Leeway to Public Relations Overdue

There are excellent exceptions (and industry can thank God for them) to these sore points, but they are not numerous. It would call for being shot at sunrise if all at once the PR's of the industry demanded that their bosses go to school and learn about Joe Public. Or they would be fired forthwith (or sooner) if they busted into THE office and demanded that ALL supervisors, at the staff and line level, should be groomed in the details of dealing with the public. But some PR's don't know Joe Public any better than the

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THESE are the people who will vote someday — for or against — more government in business.

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boss. They have to call in pollsters to find out what their own workers are thinking about.

Yet some day a few hardy (there have been some) souls, who forget that they must eat, will start a revolution—on a grand scale. If they don't, the working press will keep its mouth shut and curse inwardly, speeches will be tossed in the waste basket or given small space, answers to politicians which ought to be known by everyone will be lost or not given and Joe on the street will go merrily along listening to those who attack the industry in good old fashioned simple language.

With the schools, with the so-called intelligent class, with the customers, with the bankers and with almost everyone except the great multitude the steel industry stands in high esteem. Polls show it (please qualify). So what do some PR's think should be done—quickly. Let's take a look.

It is good to remember the story about the chief designer and president of an aircraft company and his PR. They were out to lunch. The PR started to draw a new design for a plane on the lily-white tablecloth. Mr. Big was astounded, then speechless, then began to take a burn. "What the hell do you know about designing planes?"

"Nothing," said our heroic PR. "What do you know about public relations?"

They say a good old local community relations program is worth while. It is a delicate job. One bad hitch and in the ash can the effort goes. But some people are making hay on this. They are starting at home, among the local workers and their families. But bosses have to leave their air-of-hauteur back in the office on that day—if they are to be paraded before the people. Chances are they ought to be taught their job before the community day is sprung. But the best advice anyone can give them is—be human. It is hard to do sometimes but they say it pays off.

Maybe some of the present steel presidents or vp's can be taken in hand and turned out in a short time to the public as men who do not work all day and night or not at all, but as people who eat, sleep, work, get tired, bat the kids around, do what the wife says, think some friends are pain in the necks, like to leave their shoes off when no one is around, have to be driven to shave sometimes, feel like tearing the telephone off the stand when they get night calls, read detective books and believe in Santa Claus. If he can be made to look like what he is—without polish, fanfare or gobledegook—he can talk Joe Public's language—and Joe may start to believe him. At least JP will absorb less of the claptrap about steel which he hears from those outside the industry.

Steel People Are Human Too

All steel people are like other people. But one would not know it from their public appearances or their gems of wisdom duly received in releases. In the past 10 years it would be a tough job to find any steel leader who ever publicly said he made a mistake—or was wrong. Yet we expect Dr. Gallup to wear sack cloth and ashes because he missed the boat once. Most people are born with little or nothing, get not much more than that while they live and die about the same way. They would rather gossip than read tough stuff. It sounds better. But they do like other people—it seems to be their failing and other people's undoing.

Radio programs sponsored by steel firms are great—for the people they reach. They hit cus-

Steel Distribution by Consuming Industries (1939-48)
(In Thousands of Net Tons)

	1939		Yearly Average 1941-44 Inc.		1945		1946		1947*		1948**	
	Tons	Pct	Tons	Pct	Tons	Pct	Tons	Pct	Tons	Pct	Tons	Pct
Agriculture	1,421	3.6	1,565	2.4	2,426	4.3	2,100	4.3	2,422	3.81	2,700	4.11
Aircraft	.....	....	5,557	8.8	5,521	9.7	32	.06	44	.16	39	.06
Automotive	5,906	15.1					7,379	15.1	10,292	16.30	11,044	16.81
Construction and Maintenance	6,100	15.6	8,379	13.3	8,353	14.7	8,130	16.7	10,039	15.90	13,048	19.86
Containers	2,978	7.6	4,216	6.7	4,333	7.6	4,749	9.7	5,596	8.87	5,788	8.81
Machinery, Tools	1,460	3.7	3,191	5.1	4,739	8.3	4,438	9.1	5,648	8.96	5,565	8.47
Oil, Gas, Water, Mining	1,842	4.7	2,221	3.5	2,670	4.7	2,480	5.1	3,833	6.08	2,714	4.13
Pressing, Forming, Stamping	1,842	4.7	2,809	4.5	3,800	6.7	3,127	6.4	3,770	5.98	4,244	6.46
Railroads	3,250	8.3	5,422	8.6	5,268	9.3	4,764	9.8	5,999	9.50	6,189	9.42
Shipbuilding	518	1.3	9,657	15.3	3,374	5.9	320	.64	373	.59	638	.97
Exports	2,817	7.2	7,701	12.2	3,793	6.7	3,378	6.9	4,639	7.36	3,607	5.49
All Others	10,933	28.2	12,212	19.4	12,669	22.2	7,879	16.2	10,402	16.49	10,124	15.41
Total	39,067	100.0	63,490	99.8	56,946	100.0	48,776	100.0	63,057	100.00	65,700	100.00

* Revised. ** Preliminary.

Let's Show Him As He Is . . .

tomers, well heeled citizens, oldsters, stockholders and others. But do they reach the 20 to 25 year olds, the young blades who are out for the evening, the youngsters who are in bed but who will run the show in a few years? Probably not. Maybe the answer is simple. If these people's interest is to be gained they have to be given the type of program that first gets their attention even if it means giving away some of the money the stockholders claim they don't get. Some day they may not get any. That ought not to be a hard problem for experts who really know what the public likes.

The working press (not the managing editors or the top editors) is a section of the man on the street. Their reactions are pretty much the same. They are trained to be as objective as possible. But no one really believes that there is such a thing as pure objectivity.

When the reporters or the rewrite men run into situations where they can't get what they want. Or don't get anything. Or get lectures instead of news. Or get evasions. Or get "no comment"—it doesn't help the company's relalations much or the industry's for that matter.

Seldom do top steel men have press conferences with complete give and take. Two or three companies have press conferences. They are good at that time. But before and after them it is difficult to get anything that is worth sinking a newsman's teeth into. The trend may be toward more press conferences, with less and less "off the record" material. Off the cuff stuff is hardlly any good to anyone. Most of it would make good news and is human—and ought to replace some of the on-the-record dope.

The public relations man who places honesty, understanding and principles above everything else; who sees things as they are and not as the avalanche of "yes" men would like to have them—he is the fellow who will take steel out of its place far down the line in relation with the public. It is tops in production, safety, wages, customer relations, research and other things but the majority of the people run the country.

Nationalization of steel is not a figment of the imagination—it is something much closer to home. Is the steel industry really ready to take steps to prevent this? If so, a review of the entire public relations approach is in order.

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labor

Management in 1949 will face an ebullient group of labor union negotiators. Encouraged by Harry Truman's November victory, the unions will confront the mediators, this author predicts, with heavy pressure for new pension and insurance benefits and, following the inevitable modification of the Taft-Hartley Act, new emphasis on closed shop contracts. The fourth wage round is considered a fait accompli

By W. V. PACKARD
Assistant News-Markets Editor,
THE IRON AGE

When an embattled Harry Truman turned the tables on the experts last Nov. 2 he changed the entire outlook for labor in 1949—and perhaps for years to come. The Taft-Hartley law is doomed. Use of injunctions will be strictly limited. Non-Communist affidavits will be eliminated, or will be required of both labor and management. Subjects for collective bargaining will be a fourth wage round, pensions and insurance and the closed shop. If unsuccessful, labor will insist on its "right to strike."

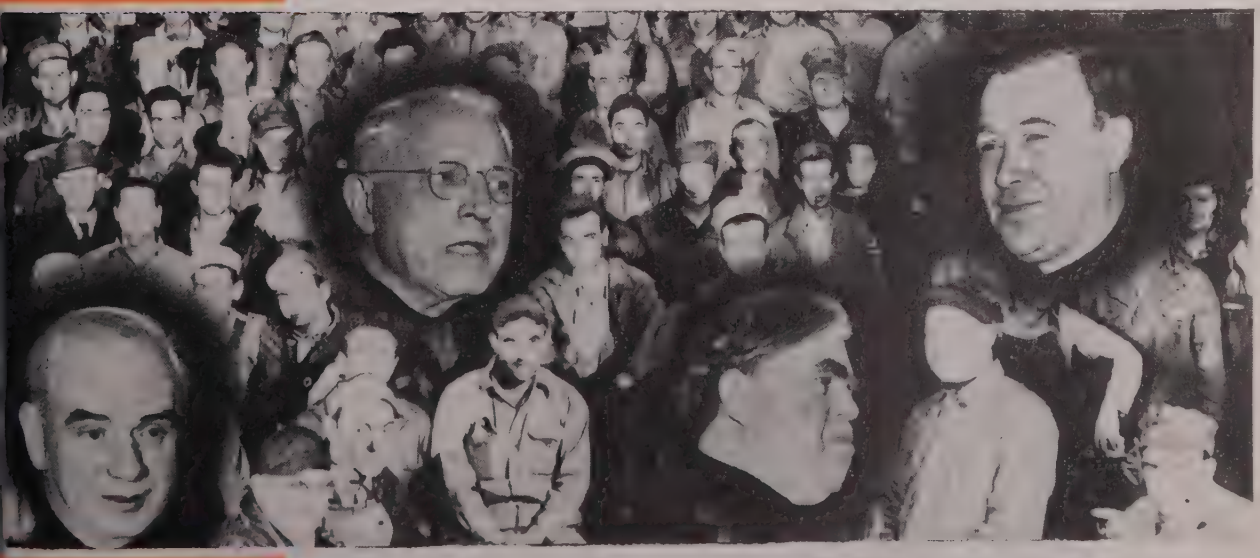
Harry Truman's victory also threw a blanket over the smoldering spark of a labor party. At the same time it fanned the spark of political action, which had been dimmed by the "bleak psychology of the Taft-Hartley law."

Prior to the November election there was growing sentiment in both the CIO and AFL for a genuine labor party. Proponents of the labor party idea could point with authority to previous failures on the part of unions in political action campaigning within the established parties.

In 1946, for example, unions tested their political strength in 14 election contests. They lost 13 and won only a partial victory in the remaining one. Not only that, many "anti-labor" candidates rode to easy victories, partly as a result of having been marked for political extermination by PAC. This, added to Taft-Hartley psychology, left unions at low-ebb politically. At least a great many people thought so.

Union proponents of a labor party made capital of all this. One of the loudest labor party spokesmen was Walter Reuther, president of CIO's United Auto Workers. He suggested that unions get together after the 1948 elections to form a genuine progressive political party. The movement got unexpected support when William Green, president of the AFL, was quoted as favoring a new labor party. Mr. Green later denied that he had flatly backed such an idea.

Another factor which contributed to the growing third-party sentiment was labor's luke-warm support of President Truman. Important forces within the ranks of labor have long felt that President Truman is not really as liberal as he sometimes sounds. He certainly was not the candi-



date of their choice. But they were unwilling to attach themselves to the Wallace effort—at a time when they were anxious to convince the public that they were purging their ranks of fellow travelers.

Labor thus lined up behind the President as a sort of compromise candidate. Meanwhile, strange things were happening to the Democratic party. Henry Wallace led the left wing off on one tangent, while the conservative, southern right wing formed another. It looked as if Mr. Truman were holding the bag. It was at this point that organized labor (especially the CIO) settled down to some serious, eleventh-hour campaigning.

Gone was the flamboyant showmanship which had been such a characteristic of futile PAC campaigning in the past. After all, labor had suffered a series of crushing defeats while using those methods. It had been beaten at the polls and in Congress (the Taft-Hartley law). So it returned to the time-tested methods of campaigning which have been winning elections ever since the party system evolved in this country.

Labor didn't expect a sweeping victory. Its aim was to elect as many friendly congressmen and senators as possible. This was to be used as a base from which to work—possibly toward a labor government by 1952. In most areas its support of labor-endorsed candidates was more whole-hearted than its support of the President. This was the high tide of the labor party movement.

The methods used by labor in its eleventh-hour campaigning were more typically those of a political party than of any union—at least they were, based on past performances. Perhaps this was because labor was already thinking in terms of a labor party. Maybe it was because labor leaders recognized the ineffectiveness of their past efforts.

At any rate the campaign was conducted on a house-to-house basis. They used telephones, rang doorbells and provided automobiles to take voters to the polls. They also kicked in generously with cash. This was a basic political campaign on the part of labor. Not as spectacular as the former efforts of PAC, but far more effective.

The very success of labor's political campaign squelched whatever hopes it had of forming a labor party—at least in the near future. Labor leaders are quick to stress that their organizations are in politics to stay. But they are just as quick to point out that they will continue to work through existing political parties. At present, this means the Democratic party.

President Truman is not a labor president. In the end he won the support of organized labor because his platform most nearly approximated the aims of labor. Also because he made a strong bid for the labor vote by repeatedly calling attention to his veto of the Taft-Hartley act. Labor still regards the President as an acceptable compromise. Not as its champion.

Labor's success at the polls lent an enthusiastic air to the CIO convention in Portland late in November. There the victory of labor received a great deal more acclaim than the victory of the President. Beneath the zeal and fanfare several forecasts of what might be expected in 1949 became apparent.

Three big points emerged. They called for (1) general housecleaning of Communists, (2) total repeal of the Taft-Hartley law and (3) fourth round wage increases. Not to be overlooked is Philip Murray's strong stand in his opening address on social insurance and pensions. These are not new aims. But Mr. Murray feels the time is ripe. He will press those points when he sits at the bargaining table next year.

Power to investigate unions which have failed in organizing the unorganized was voted to the CIO executive board in the closing days of the convention. It followed a blast by CIO President Murray that he will not defend "pouting officials" or "protect cliques whose interests are promoted by the 'Daily Worker' and the Communist party." He demanded that certain unions do the job which they were chartered to do.

"I should like to have such organizations—and there are only a few—as may be engaging in Communistic activities to cease and desist, and to develop the trade union movement, and to carry out the policies of the CIO. Under no circumstances am I going to permit Communist infiltration into the national CIO movement. I make that statement with sincere conviction, based on a knowledge of the damaging, devastating and degrading effect that special outside interests, particularly the Communist party, may have on organized labor in America."

Most unions seem to have learned that they must be free of Communists and Communist influence if they are to be treated with a sense of respectability in their relations with employers, the government, and, most important of all, with the general public. Some have learned this the hard way. That they have learned is important.

It is a shame that many loyal, patriotic American workers have suffered a stigma through union association with fellow travelers. Most of this dates back a decade or so when all unions were engaged in a mad scramble of organizing. Unions, engaged in the biggest organizing drives of all time, welcomed all prospective members with open arms. In the race for numbers, they didn't bother to ask prospective members whether or not they were Communists—Some of them were.

In some cases more harm than good came from the organizing drives. And so, more than 10 years later, labor is still painfully sorting the accumulated harvest of its broadcast organizing seed. It almost waited too long. While the task is painful, the stakes are high. For only when this task is completed will labor have gained the one aim it seeks above all others—respect and dignity.

Specifically, how will Mr. Murray lead the fight to bring leftist unions into line with CIO "policy?" The CIO executive board's recent order to the United Farm Equipment Workers to merge its 65,000 members into the United Auto Workers within 60 days might be an example of the tactics which will be used.

The farm equipment union leaders lost no time in condemning the ultimatum as an "obvious

conspiracy to destroy a duly chartered and long-standing union." They declared that no action toward compliance would be taken until the issue had been put before the organization's convention next March 25. It is expected that an agreement on the merger will be worked out before that time.

Mr. Murray's leadership of the CIO is as firm as it ever was. And that's pretty firm. It appears that he has more than enough backing to go as far as he wants in his purge. That the fellow travelers he kicks out might not be welcome elsewhere avowedly is no concern of his.

The Portland convention was not wholly dedicated to internal problems. Considerable attention was given to a legislative program. It was pointed out that the CIO "movement is not a tail to any political party." Labor leaders have denied that they feel they have a stake in the present government. They phrase it a bit differently. They say that they regard the outcome of the election as a mandate from the people for enactment of legislation (they enumerate) which coincides with their program.

Prompt repeal of the Taft-Hartley law is number one on the union's program. It also easily won top billing at the AFL convention in Cincinnati. Both unions favor complete repeal of the law and a return to the Wagner act. The Taft-Hartley act looks a cinch to be repealed. But it is doubtful if labor's legal status will revert all the way back to the Wagner act. Best bet is there will be a compromise. Some other changes which appear likely are:

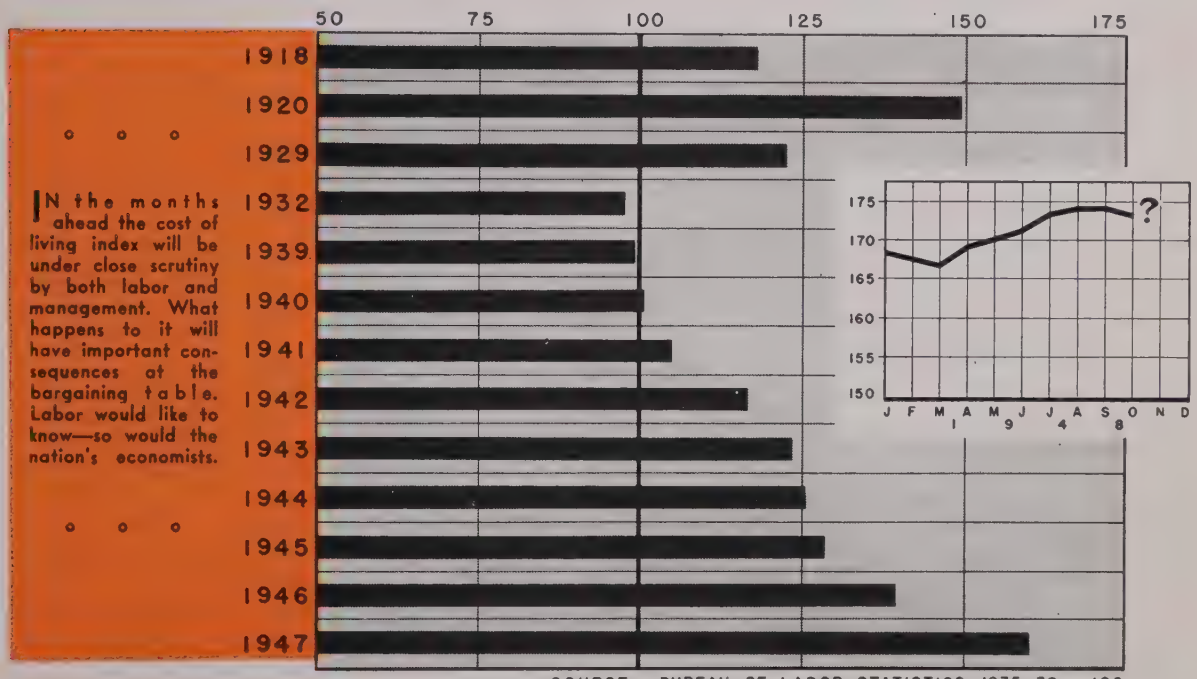
(1) There will be no requirement for non-Communist affidavits. Or, if political expediency deems them necessary, employers will have to sign them, too. A real showdown on this issue never did take place. Mr. Murray didn't sign up. But no one ever challenged his United Steelworkers, who could not even have qualified for a position on the ballot to select a bargaining agent.

USWA has already asked the Supreme Court to rule on this requirement. This grew out of the now famous Inland Steel Case. The Seventh Circuit Court ruled that pensions were a subject for collective bargaining. But it also ruled that the bargaining could not be held until union officials signed non-Communist affidavits. Chances are remedial legislation will precede any review by the Supreme Court.

(2) The injunctive processes of the Taft-Hartley law will be eliminated. But presidential power to enjoin national emergency strikes will be maintained. These would include coal, transportation and utilities—also government. Labor regards any provision for injunction with blackest suspicion. It feels this compromises its "right to strike." The conflict here is between labor's "right" and public's "welfare." It will not be finally settled this year. Future elections will decide whether the two are identical, compatible or incompatible. Meanwhile, a compromise will be tried.

(3) The new law is expected to place some restrictions on jurisdictional strikes, secondary boycotts and featherbedding. These practices will get no more than token defense from labor. They were curbed under Taft-Hartley and were hardly missed. Some

CONSUMERS PRICE INDEX — THE COST OF LIVING



SOURCE: BUREAU OF LABOR STATISTICS, 1935-39 = 100

IN the months ahead the cost of living index will be under close scrutiny by both labor and management. What happens to it will have important consequences at the bargaining table. Labor would like to know—so would the nation's economists.

What Unions Will Bargain for in 1949

(1) All unions will ask for a fourth wage round. Demands will probably be more moderate than in the previous rounds.

(2) Some CIO affiliates, especially the steelworkers, will press for pensions and insurance, as well as higher wages. AFL's chief interest is still in wage increases.

(3) The Taft-Hartley law is doomed. After the new labor law is written unions will intensify organizing efforts. CIO will be more aggressive. Some small unions will be spurred by Mr. Murray's ultimatum to organize—or else.

(4) A few unions may be expected to go for shorter hours—without reducing take-home pay. Miners will be in the forefront on this issue.

(5) With the issue of the closed shop expected to revert to the bargaining table, unions will place it near the top of the list of demands. The printers will press this one hardest.

(6) Jurisdictional strikes, boycotts and featherbedding will continue on the wane—because they are unpopular with the public. On other issues labor will insist on its "right to strike." Some strikes in major industries, including steel, may occur. Best bet is that they will be of short duration.

of labor even feel that it is better off without them. At least its relations with the public are better without them.

(4) Elections likely will be used only to choose a bargaining agent. All others will be out. This would mean that the closed shop would be returned to the bargaining table. This has been an exceedingly sore point with the printers. They can be expected to be in the van of a fight to restore the closed shop if provision for it is not written into the new bill.

Writing the new labor bill will be one of the first and best opportunities the new Congress will have to display real statesmanship. On one hand stands labor for complete repeal of the Taft-Hartley law. On the other stands management for its retention. Somewhere between stands the "mandate" of the people. This will be the biggest single event in the field of labor relations during 1949—and perhaps for years to come. Seldom does the outcome of so many events hinge on the direction of a single one.

Other measures were advocated in the program adopted by the CIO Portland convention. Mr. Murray listed them as follows:

(1) "Restoration of price controls on certain commodities that were depressing, through inflationary processes, the living standards of the American people.

(2) Restoration of the excess profits act.

(3) An all-out attack on all forms of monopolistic control.

(4) Advocacy of a system designed to sustain the farmer in his struggle to produce for his family decent standards of living.

(5) Institution of a basic one dollar per hour minimum wage for all workers in the United States.

(6) Institution of ample social security and pension legislation to protect the interests of all workers.

(7) American industry must expand its facilities and improve its plants."

The AFL convention approved essentially the same program, except that it did not call for price controls. In both conventions the subject of wage demands was less in the limelight than in previous postwar years. Nevertheless, both unions left no doubt that they will seek fourth round wage increases this year.

The size of their demands will depend largely on whether prices go up or down. Unions and management alike will be closely watching the Bureau of Labor's consumers price index in the months ahead. Probability is that unions will start their demands this year at a lower asking figure than in previous wage rounds.

But the CIO, at least, will be asking for more than a fourth round wage increase. It will bring insurance and pensions to the bargaining table. Mr. Murray has been talking about these things for a long time. They are part of the unfinished business which makes him stay on as president of the CIO and USWA. He feels that this is the year to get them. Doubtless he would rather have steelworkers remember him as the man who got them pensions and insurance than the one who got them so many cents in 1949.

Another factor which may turn more union effort in the direction of fringe demands is the growing feeling that wage increases are useless if they are followed by price rises. To be sure, all unions will insist that the increases they ask can be granted without increasing prices. This is especially true of the United Auto Workers, who will again insist that the companies show them the books. But unions know they have little chance to get management to agree not to increase prices. If wage demands are big, they have no chance at all.

Responsible labor leaders realize that successive wage-price increases help no one. They harm many. They feel that there is more real gain to be made in the direction of pensions and insurance than there is in wage increases which likely would be wiped out by price rises. This won't stop them from going for both.

There is a strong feeling in the ranks of labor that 1949 is the year to get some of the things it has been wanting. There is a feeling that "we'd better get it while the getting is good." That by the time 1950 rolls around another round of wage increases might not be almost a forgone conclusion—even in the minds of management. The removal of Taft-Hartley frustrations will make them the more impatient.

On the other hand, there is considerable feeling, especially among some top policy leaders, that it is time to become more cautious. For one thing, they are trying to woo the farmer. And they fear that if demands are too high his support might be irretrievably lost. In spite of the election outcome, some do not feel too secure politically. They would like to pursue a path of moderation until they have had a chance to further strengthen their hands.

The question of how much is asked will depend somewhat on what happens to the cost of living index in the months ahead. Labor and manage-

ment are both watching this criteria very closely. It has already been incorporated into the General Motors wage formula. It has become almost a household phrase. As a true yardstick of the cost of living, it is far from perfect. But it is well known, and it is used for lack of a better index.

It has been suggested that wage formulae tied to the cost of living index might be widely adopted in the near future. This doesn't seem likely. Labor itself is not sold on the idea. Maybe it remembers that the historic pattern has been for wages to trail prices on the way up—but also on the way down.

Labor's chief objection to the cost of living index type of wage formula is that it is based on a "theory of defeatism." It feels that accepting such an approach to the question of wages would be an admission that it is quite content with the present or existing ratio between wages and prices. One spokesman said, "We would be nailing ourselves to the status quo . . . As time goes by we expect to improve our position through collective bargaining." Such a pattern might be accepted eventually, but not soon.

What does the working man want? He wants a lot of things. But most of his wants fall under three main headings: Better living conditions, better working conditions and security.

The worker has never been sold on the advantage of higher productivity. He never will be sold on it until he becomes convinced that it is a matter of great personal concern to him. He knows that he buys the things he needs with his paycheck. And he feels that the more articles he makes the more money his employer will have to put in the bank. Meanwhile, he keeps pressing for more money in the pay envelope.

Such are a few of the working man's thoughts on better living conditions. That some of his thoughts are not correct is as much the fault of management as of himself. It is only in recent years that management has bothered to attempt to explain a few of these things to him. Many companies who have long followed the practice of making detailed reports to stockholders have never tried to explain company finances to the workers.

The worker resents this. He feels that the company is holding out on him. That it is making a great deal more money than it says. Moreover, he wants to feel that he has an interest in the company and he is frustrated by a lack of knowledge of its affairs. Some companies who have bothered to explain what happens to their gross income have been more than repaid by the improved labor relations which resulted.

Fortunately the story of better working conditions is a happier one. Here is a field of vital importance to labor relations in which labor and management, with some exceptions, have been doing a remarkable job of cooperating with each other. Much remains to be done. But much has been done. It was not always so. Management has learned that providing better working conditions makes for greater productivity. The steps to improve working conditions have been rapid, and they are continuing.

Murray Stresses Pensions and Insurance

" • • • There are other matters to which we must necessarily direct our attention, and that is that in the field of collective bargaining we must make social insurance and pensions an issue in each collective bargaining conference with employers.

"American employers have definite responsibilities and obligations which run beyond their stockholders. They are no longer mechanisms created for the mere protection of those who invest monies in their properties or their enterprises.

"These corporations and great business enterprises in the United States of America have definite social obligations which run to the people, and they must now begin to realize the necessity of assuming those obligations, sensing those responsibilities and meeting the representatives of those unions of ours in a spirit of amity and good will and giving ample recognition to the institution of decent social security programs and pensions for all workers employed in American industry."

These words are a portion of the opening remarks of Philip Murray, president of CIO and USWA, before the CIO convention in Portland last November.

Security, to the worker, includes a broad field. In that word are wrapped many of his wants and fears. He may never have had a course on the business cycle—or economy theory. But he knows what a depression is, and he fears it. He also fears old age without an income. As a result of these fears he wants a guarantee of a specific annual wage and assurance of an income when he is too old to work.

Many types of insurance and pension plans have been in operation for a number of years. The pressure for them is increasing. This year they will be in the limelight as a subject for bargaining more than ever before.

In this year of sweeping changes in labor management relations one factor at least is slated to remain constant. That is collective bargaining. If our government has any policy of continuity on labor, that is it. This brand of domestic diplomacy has proven the best mediator of differences yet tried. It is still the brightest hope for industrial peace. Since labor and management have both felt the hard hand of government restraint, they have a real incentive to make it work.

At the bargaining table top leaders of management and labor have learned to know and respect each other as men. They have had their differences—and their battles. But they have found common ground. They have agreed.

Collective bargaining is not an easy job. It requires hard work, patience, and, sometimes, real statesmanship. That's why both sides choose their best men for this work. Sometimes the job is a trying one—even for the best.

Labor relations have come a long way since labor's only redress of grievance was the strike, and management's only protection, the lockout. There is still a long way to go. The stakes are high. For labor they are respect, dignity and a better way of life. For management they are production, public esteem and freedom within a system of free enterprise.

world steel

Straining to fill an overwhelming civilian demand and a fast budding rearming effort, world steelmakers in 1948 set a new peacetime production record, with the U. S. contributing 52 pct. of the global total, and Russia 13 pct. International uncertainties, however, continue to serve as a goal for further expansion programs throughout the world. And over a large portion of the world's steel facilities, nationalism casts an ominous shadow.

By S. D. SMOKE
Associate Editor,
THE IRON AGE

World steel production in 1948 skyrocketed to a new peacetime high. Ingot output for 21 countries totaled an estimated 168,812,000 net tons as compared with the previous peacetime peak of 150,780,000 in 1939.

The all time high was set during the war in 1943 when the world's furnaces tapped enough steel to make 184,461,000 tons of ingots, about 15,649,000 tons more than during the past year.

Pig iron production also showed a substantial increase. Blast furnaces made in 1948 an estimated 120,649,000 net tons of iron. However, this total is 9,392,000 tons short of the 1943 record of 130,041,000 net tons but still 13,550,000 tons higher than the peacetime peak. Detailed statistics on world production are given in the accompanying tables.

It is significant that even though ingot production is up 15,649,000 tons over the previous peacetime high in 1939, United States production was 35,655,000 tons higher than in that year, when many of the European countries were in the midst of a tremendous armament program.

Now much of the rubble has been cleared. Almost 3 years have been spent in reconstruction, modernization and expansion. Great progress has been made. Yet many difficult problems confront industry and government officials in all nations.

In Britain the industry faces nationalization. Australian heavy industry is gradually losing workers to the newer and steadily growing light manufacturing industry. Brazil, and Russia in particular, despite increases in production, face a shortage of technically trained men. France is beset with strikes in the steel and coal industries. Germany is cut up into four uncoordinated zones and those in control of each zone can't get together with each other or the Germans on what should be done and how. But each country keeps pushing output higher and higher. And plans for 1950 to 1952 aim for a total world production of more than 200 million tons of steel.

The interesting aspect of the proposed expansion programs is that

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different countries have different reasons for embarking on ambitious programs. Demand for steel is strong practically everywhere. Former agricultural countries are being industrialized. They feel that for a balanced domestic economy they must become steel producers so that they won't be dependent on other nations for their steel supply. Countries like Britain, Belgium and Luxembourg are increasing production for lucrative export returns in addition to satisfying domestic requirements. United States and Russia are still desperately endeavoring to satisfy tremendous civilian needs, with the cold war adding a somber urgency to demands for more capacity.

United Kingdom: The iron and steel industry Nationalization Bill has received its second reading in the House of Commons. Hot words have already scorched the parchment. It is now being referred to a special committee composed of members from both parties. The bill calls for ownership of some 107 companies to pass from private hands to a public holding company—the Iron & Steel Corp. of Great Britain. The companies would still retain their names, management, directors and publish individual accounts. But instead of paying dividends to their present stockholders, they will pay them to the new corporation.

British Steel Capacity Goal

The one thing the country may gain from the bill in terms of steel alone is more capacity. The government has set its sights on a goal of 24 million net tons for 1960 while the British Iron & Steel Federation continues to think in terms of not more than 20 million net tons of capacity by that time. When it comes to this objective, the government can get what it wants by passage of the bill.

That it will be passed seems inevitable. The government has decided to apply the guillotine which means that passage of the bill through the committee stage will progress on a rigid timetable basis.

Right now the Labor party is dominant and it appears that they will push the bill through. However, an important factor is the third, or Liberal, party. They polled 8 million votes at the last election. Although the Labor party is in power there is a large enough vote in the Liberal group to throw the elections either way. But it's still almost a certainty that Britain will end up with a Nationalized steel industry despite the fact that the industry produced in 1948 1,960,000 tons of steel more than ever before in its history.

As the controversy rages, steel men are doing a bang-up job of showing that Nationalization is unnecessary. Sir Stafford Cripps, Chancellor of the Exchequer, set a target of 15.5 million net tons of steel for the year. When things were going far ahead of schedule, he jumped the ante to 16 million tons. And the industry went right on to make 16.5 million net tons for the year.

Britain is aiming for a production of 18 million tons of steel by 1950. That is what they anticipate demand will be by that time. But several important problems present themselves in achieving that goal.

Coke is in poor supply. Quality, too, is not up to prewar par. Many plans have been advanced for both increasing coke oven capacity and miners' efficiency. One thing does stand out, however. If Britain is to add more steelmaking capacity or get the most out of her present capacity, more coal must be mined and additional coking capacity constructed.

Scrap supply creates another big problem to increased steel production. Although Britain has obtained more than a million tons of scrap from Germany this year, she is still short. The situation is further aggravated by the fact that (1) scrap consumption has increased substantially due to coke shortages, (2) intra-European scrap movement has decreased because countries previously exporting scrap now need it for home consmption and (3) Europe is exporting considerable tonnages of scrap to overseas countries.

The crux of the whole matter, however, is that where the United States in prewar days was a large exporter of scrap, she is now importing considerable tonnages. Countries like Britain and Italy always were big importers. So besides not getting any scrap from the United States, they have to share some of the present supply with her.

Russia: Soviet output of steel and pig iron increased sharply in 1948. Estimated ingot production was 22,220,000 net tons, 1.5 million tons above the previous high in 1940, and about 5 million tons over 1947. Since increases in production for 1946 and 1947 totaled less than 3 million tons, this means that almost twice as large a gain in production was made in 1948 than in both the previous years.

Three important reasons for the success of Russian steel operations during 1948, according to *Pravda*, are as follows: (1) Improvement in the handling of raw material stocks, (2) improved labor productivity and a more adequate supply of labor, (3) completion of new steelmaking facilities and restoration of mills destroyed during the war.

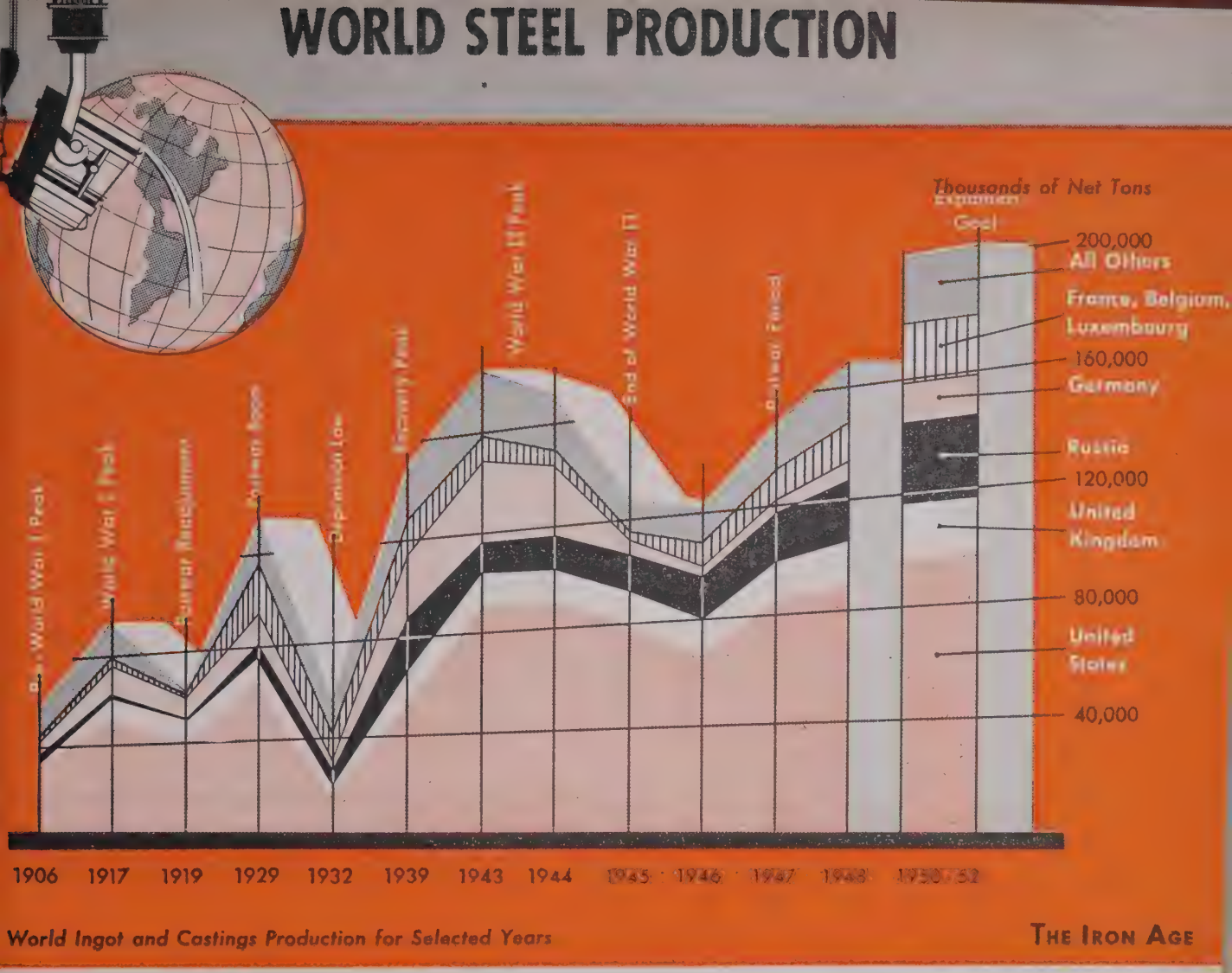
In early 1947 many mills had inadequate raw material stocks and were forced to shut down or curtail production for considerable periods when storms and snows delayed raw material deliveries. As a result of this difficulty, late in 1947 the government set up a stockpiling program and when bad weather came in 1948, supplies on hand at the mills were the largest in years.

Soviet Productivity Improves

This, together with a relatively mild winter, permitted plants to operate normally all through the usually difficult first quarter. As a result output during this period was some 40 pct higher than in the previous year.

Official Soviet data point out that the productivity of labor was some 20 pct higher during the first 9 months of 1948 than during the same period in 1947. In part this reflects the natural improvement in efficiency of the new workers who entered the industry in 1946 and 1947 and who have been accumulating on-the-job experience.

Government agencies also point to their mone-



tary reform late in 1947 as a reason for better labor productivity. At that time workers' savings were almost completely wiped out. The government pulled in all the rubles and issued one for four. But at the same time the real value of the worker's take-home pay was increased substantially. This, they claim, gives the worker more incentive to increase his earnings by raising his daily output.

Probably the largest contributing factor to the record breaking output during the year was restoration of war damaged mills in the Ukraine and completion of mill expansion programs begun in 1945 in the Urals and Siberia.

The iron and steel industry in the Urals, particularly at the large Magnitogorsk mills, is reported to have reached its 1950 production rate during the middle of last year. The Red October plant in Stalingrad is supposed to have reached its prewar production level in August.

During the first 10 months of the year, three blast furnaces were rebuilt in the Ukraine at Zhdanov (formerly Mariupol) and at the Red October plant in Stalingrad; five openhearths were rebuilt at the Zaporozhstal plant in Zaporozhe; a tube rolling mill was constructed at the Karl Liebknecht plant in Dnepropetrovsk mainly to supply the oil industry; a wire mill was put into operation at the Dzerzhinsk mill in Dneprodzerzhinsk and a new rolling mill has been set up at the Navo-Tagil metallurgical plant. Besides these new facilities, those inaugurated in 1946 and 1947 operated much nearer capacity during the past year.

Russia is aiming for an output of 27.5 million net tons by 1950. She is going all out to achieve this goal. The big drawback in the past has been an insufficient supply of technicians. But added emphasis on this shortcoming is gradually alleviating the situation.

Germany: A once mighty metal empire has been cut to ribbons and tied up in little knots. A potential of 26 million tons of steelmaking facilities is chopped up into 4 nonintegrated parts. The British zone which includes the Ruhr contains 71 pct of the German steel capacity; the French zone which includes the Saar, 12 pct; the Soviet zone, 10 pct, and United States zone 3 pct.

These four powers at present control the destiny of what was once the second largest steel producing nation in the world. Russia has stripped her zone almost clean by dismantling

World Pig Iron Production

(Thousands of Net Tons)

Compiled by THE IRON AGE from the United Nations Bulletin of Statistics, Chambre Syndicale de la Siderurgie Francaise, British Iron and Steel Federation and the American Iron and Steel Institute.

	1948[1]	1947	1946	1945	1944	1943	1942	1941	1940	1939
Australia	1,331	1,157	951	1,254	1,465	1,571	1,742	1,650	136	124
Austria	609	306	063	112	....	....	....	....	....	....
Belgium	4,217	3,102	2,389	805	779	1,795	1,399	1,558	1,967	3,366
Brazil	563	529	408	260	321	273	235	230	205	176
Canada	2,320	2,112	1,518	1,967	2,020	1,954	2,178	1,729	1,452	924
Czechoslovakia	1,814	1,571	1,056	634	1,742	1,874	1,756	1,729	1,782	1,769
France	6,591	5,373	3,356	1,307	3,181	5,412	4,124	3,683	4,052	8,118
Germany	6,360[2]	3,221[2]	2,437[2]	4,400	20,990	26,718	24,506	23,561	17,136	20,363
Hungary	409	334	176	013	....	459	459	486	459	451
India	1,706	1,716	1,474	1,492	1,584	1,953	2,046	2,244	2,231	1,867
Italy	666	422	224	083	341	780	1,074	1,226	1,236	1,209
Japan	839	409	211	580	2,996	4,528	4,831	4,805	3,999	3,696
Luxembourg	2,841	1,993	1,505	343	1,478	2,411	1,861	1,478	1,162	2,020
Netherlands	498	317	206	....	....	....	....	....	....	313
Poland	1,201	951	790	277	....	....	....	....	....	....
South Africa	711	670	616	611	519	536	401	345	334	330
Spain	575	553	540	517	607	644	546	589	638	548
Sweden	783	718	770	854	951	887	824	806	837	721
United Kingdom	10,274	8,540	8,660	7,933	7,550	8,026	8,588	8,250	9,187	8,897
U.S.S.R.	15,620	12,980	11,440	10,230	9,600	8,300	7,700	12,800	16,500	16,810
United States	59,385	59,314	45,547	54,166	62,073	61,920	60,115	56,070	46,979	35,396
Total	119,313	106,288	84,337	87,838	118,197	130,041	124,385	115,814	110,292	107,098

[1]Estimated Production.
[2]British, French and United States Zones.

plants and carrying them home as reparations. Britain wants to dismantle over 9 million tons of capacity in the British zone and reduce the production potential to 10.3 million tons. France wants to keep a death grip on the Saar and wants to see Britain strip her zone so that the German industry will never again be a threat to French national safety.

The United States in the meantime, and ECA administrator Paul Hoffman in particular, is opposing destruction of German industry. Mr. Hoffman can't see pouring American aid into this country and at the same time have Britain and France destroy any possibility the German people have of getting back on their own feet.

Present plans call for German capacity in the British zone to be cut to 10.3 million tons. The Germans are fighting for a maximum permissible output of almost 15 million tons. Before the war, the Saar made 3 million tons of steel so that if and when that figure is reached again, there could still be an output of 18 million tons of steel a year in Germany again.

This year German output will hit about 7.5 million tons. Of this amount, about 6 million tons will come from the British zone, 1.2 million tons from the Saar and 300,000 tons from the U. S. zone.

Latest development in Germany is word that British and American authorities have authorized liquidation of the Ruhr combines and that ownership of heavy industry will be tranferred to 12 German trustees. These trustees are to take the place of the former owners until a German government is formed and the German people decide the question of ownership and management of the industry, which would still be subject to Allied supervision. France has already gone on record as strongly opposing this plan.

Austria: The most significant development in Austria is complete reorganization of its iron and steel industry. A holding company has been formed to carry out the technical and production programs which have been set up for the nationalized iron and steel industry of the country.

Previously it had been the duty of the Austrian Ministry of Property Control and Economic planning, but now the activity of the Ministry will be limited to bringing into line the production of the iron and steel industry with the country's economic needs.

On the other hand it will be the duty of the holding company to advise the five subsidiaries on technical matters and to insure production targets set up under the Austrian iron and steel plan are met. Target for next year is set at 1,170,000 net tons of ingots. This year output was 732,000 tons. Otherwise the subsidiaries

World Ingot and Castings Production

(Thousands of Net Tons)

Compiled by THE IRON AGE from the United Nations Bulletin of Statistics, Chambre Syndicale de la Siderurgie Francaise, British Iron and Steel Federation and the American Iron and Steel Institute.

	1948[1]	1947	1946	1945	1944	1943	1942	1941	1940	1939
Australia	1,385	1,373	1,164	1,505	1,703	1,822	1,901	1,835	1,439	1,307
Austria	723	394	207	189	....	....	....	....	....	....
Belgium	4,200	3,181	2,508	805	670	1,834	1,518	1,782	2,086	3,429
Brazil	673	426	379	227	243	205	176	170	156	125
Canada	3,168	2,902	2,293	2,803	2,930	2,872	2,986	2,623	2,174	1,509
Czechoslovakia	3,157	2,520	1,843	1,045	2,778	2,831	2,619	2,659	2,606	2,526
France	7,368	6,338	4,859	1,822	3,408	5,651	4,947	4,751	4,864	8,763
Germany	7,350[2]	4,739[2]	3,604[2]	5,500	28,481	33,706	31,684	25,804	23,732	26,152
Hungary	816	658	389	142	766	856	865	861	827	808
India	1,300	1,346	1,373	1,426	1,465	1,518	1,452	1,531	1,399	1,135
Italy	2,409	1,874	1,269	436	1,138	1,905	2,130	2,275	2,487	2,513
Japan	1,674	1,041	608	1,177	7,032	9,676	8,760	8,349	8,288	8,124
Luxembourg	2,422	1,888	1,426	291	1,389	2,368	1,720	1,376	1,138	1,931
Mexico	360	353	277	201	199	194	104	104	104	085
Poland	2,020	1,731	1,344	546	755	870	....	....	1,600	1,790
South Africa	720	660	568	594	541	462	370	370	396	343
Spain	605	581	656	617	546	721	663	633	766	644
Sweden	1,320	1,311	1,335	1,327	1,320	1,338	1,354	1,275	1,280	1,270
United Kingdom	16,487	14,246	14,220	13,243	13,599	14,595	14,495	13,790	14,527	14,808
U.S.S.R.	22,220	17,050	15,620	14,300	13,300	12,200	10,900	16,600	20,130	20,719
United States	88,435	84,894	66,603	79,702	89,642	88,837	86,032	82,839	66,983	52,799
Total	168,812	149,506	122,545	127,898	171,905	184,461	174,676	169,627	156,982	150,780

[1]Estimated Production.
[2]British, French and United States Zones.

will maintain their independence as previously.

One of the really big problems confronting the holding company is the determination of whether some companies belong to Germany or Austria. It is likely that trustees will be appointed under the Austrian Trusteeship Act to determine the true ownership of the plants in question.

France: Strife torn and steel hungry, France gropes through a confused reconstruction program. Periodic changes in government, numerous strikes, a shortage of raw materials, unstable currency and an ill defined modernization and expansion program have retarded progress immeasurably. But still steel production rose over 1 million tons last year to a total of 7,368,000 tons of ingots and castings. This does not include approximately 1.2 million tons of steel which France got from the Saar. But with steel demand so far ahead of supply there is still not enough.

Even more steel would have been made had the country not been gripped by widespread coal and steel strikes during September, October and November. About 500,000 tons of steel were lost through these strikes.

Steel production, though below prewar levels, combined with lower exports and higher imports provided approximately 20 pct more steel for the home market than before the war. The steel shortage, however, is very acute with steel sheets and tube blanks being tightest items.

In 1947 the country embarked on the Monet plan for expanding and modernizing French industry. Although the program got underway in certain of the basic industries, the iron and steel industry turned thumbs down on the plan. They objected to a rationalization which involved certain rather drastic mergers, closures and specializations.

Latest reports now indicate that the entire Monet plan is under revision so that it will harmonize with both the 1948 to 1952 and 4-year plans being drafted by the O.E.E.C. The revised edition is expected to be laid before the Assembly soon for debate. This was never done with the original Monet plan.

France is suffering from a terrific dollar shortage. This, together with the controversial Monet plan, are two of the main reasons for delay in completing proposed expansion and modernization programs. Equipment has been ordered from the U. S. for a continuous strip mill at Denain. It is scheduled for delivery in 1950. Another hot strip mill is planned for in the Northeast District, but nothing has been done about it as yet.

Other plans that are progressing slowly for the same reasons are: construction of five blast furnaces, two of which are nearing completion at

Mont St. Martin and Micheville; rebuilding of two others at Mondeville damaged during the war; construction of four new openhearths at Beaytor, Hautmont, Hayange and Senelle; and scheduling of several rolling mills for electrification and modernization.

Belgium, Luxembourg and the Netherlands: These three low countries have probably made the best recovery progress of any of the countries in Europe, although the Netherlands has had to rely on ERP aid for a large measure of its success. Belgium and Luxembourg have hit new highs in steel production while all three have made new records in pig iron output.

Belgium is financially one of the best situated countries in Europe. In fact she has extended tremendous credits to other countries. At the same time she is putting some 7 billion Belgian francs into a large scale expansion program which includes construction of additional blast furnaces, openhearth and rolling mill facilities.

The Netherlands also is expanding existing facilities. It plans to increase pig iron capacity to 700,000 tons and steel capacity to about 750,000 tons annually by 1950.

Each has in mind the lucrative international steel market. As long as steel demand holds up the world over, their expansion programs will net early returns.

Recently a bid was made to nationalize the coal industry in the Netherlands. It was not strong. But a committee was set up to study the plan, and after some discussion it recommended that the plan be rejected.

Seek Little Ruhr Development

Poland and Czechoslovakia: These two Russian satellites combined to turn out 5,177,000 tons of steel last year. Each hit a new all time peak. But the Soviet is still not satisfied. It wants to see a little Ruhr established in the area between Katowice in Poland and Ostrava, across the border in Czechoslovakia. Polish sources state that the coal, zinc, iron and steel industries of both countries would be included in this development. It is expected that it will take about 12 years to complete the project, but it will eventually employ some 25,000 men and turn out about 10 million tons of steel. The effort was speeded up considerably when the Communists assumed control of Czechoslovakia last February.

Work has already begun on the new industrial basin's power plant in Dwory, Poland, having a capacity of 150,000 kw. Originally the power station was to have been jointly owned, but now it will be Polish owned. Poland is supplying the labor and will pay Czechoslovakia for the machinery and equipment with one half the power.

The Oder River is being made into a major transport artery with Stettin on the Baltic as a seaport. Raw materials will be a problem, but it is expected that the enterprise will depend on Sweden for iron ore while Poland will provide the coal.

Japan: Recovery in Japan continues with less interference and controversy than in any other country affected by the war. Under the present program she is not intended to become a factor in the world trade market. But her program, instead, aims at self sufficiency and sufficient increase in steel production to take care of increases in domestic steel demand in the future.

Her production in 1948 was 1,674,000 tons, as compared with a wartime peak of 9,676,000 tons and the peacetime high of 8,288,000 net tons.

Sweden: Swedish industry plods along at the same pace it has kept for years. Steel and pig iron production remains at about the same levels.

Traditionally a producer of only high grade steels, production of carbon steels took on greater proportions during 1948 than in 1947. Continually harassed by coke shortages since the end of the war, shipments in 1948 arrived in better volume than in recent years.

Iron ore reserves are quite extensive in Sweden and added emphasis was placed on their mining. Since the country, though solvent, is badly in need of dollars and sterling, government authorization has been given to export 2.5 million tons more of iron ore over the next 2 years than the usual 10 million tons normally exported annually.

Brazil: Brazilian output of steel for 1948 was about 673,000 net tons of ingots, the highest figure in the country's history. Even at that she must rely heavily on steel imports to meet the demand for about 600,000 tons of finished steel products. An additional openhearth furnace is now under construction at the Volta Redonda works where a foundry and structural fabricating shop are also being added.

Brazil has tremendous reserves of industrial raw materials such as oil and iron and manganese ores, but the country is badly in need of money and, in addition, development of industry is retarded because of restrictions placed on investors.

India: India finds herself in a tough spot. Although her estimated steel production for 1948 is set at about 1.3 million net tons, demand calls for some 3 million tons. Numerous expansion plans are in progress, but there will be a severe shortage of steel supply for at least 6 years until some of these plans materialize. In the meantime she will have to rely heavily on steel imports.

Some of the slack will be taken up, however, by (1) the completion of Tata Iron & Steel Co.'s short term program for adding 150,000 tons to its present output (its long term program calls for 600,000 tons), (2) 30,000 tons expansion at the Mysore Iron & Steel Works, (3) two new furnaces at the Ishapan Ordnance factory which will add about 70,000 tons, and (4) the 300,000 ton plan of the Steel Corp. of Bengal.

It is considered that the smallest economic unit for production under modern conditions should have an initial capacity of not less than 500,000 tons of ingots. Even if the existing steel producers complete current plans for 500,000 tons capacity within the next 5 years, it is still believed desirable to establish two new units immediately with a capacity of 500,000 tons each annually.

India Plans Expansions

The government of India has carefully considered all the data presented by experts from other countries. It has recommended the erection of a plant in Central Province and another in Bihar or at Jamalpur near the south bank of the

Ganges. The total estimated capital for erection of these plants would run about $150 million. Tata estimates that it will need $60 million for its 600,000 ton program while the Steel Corp. of Bengal is asking the government for $50 million to make its 300,000 ton expansion. As it stands right now, finance alone stands in the way of progress. And, summed up, it will take about $260 million to do the job.

Union of South Africa: If South Africa is not aiming at complete self sufficiency in iron and steel production, she has in the last 25 years done an exceptional job in both increasing steel production and eliminating the need of large scale importing. This has consequently reduced much of her dependency on other countries.

A change in government has brought a strong move toward nationalization of the industry. Plans for a large government owned plant in Rhodesia are progressing rapidly.

Each year since 1942 steel output in South Africa has risen above the previous year. Production for 1948 is estimated to be 720,000 tons of ingots. Pig iron output has followed the same pattern through the years and production for 1948 will amount to about 711,000 tons.

In 1937 the Union imported 568,000 tons of iron and steel. By 1942, imports had dropped to 143,100 tons. Because steel demand has increased here as in other countries since the end of the war, the total is somewhat higher than that figure for 1948. But expansion plans aim at reducing that figure to a minimum.

Canada: The Canadian iron and steel industry hung up a new all time high in 1948 with production estimated at 3,198,000 tons of ingots. About 2,320,000 tons of pig iron and ferroalloys, produced in 1948, also set a new record.

Openhearth capacity in 1948 was increased 215,000 net tons to 2,985,000 tons, while 30,000 more tons of electric furnace capacity brought that category up to 505,000 tons total. This brought the country's total ingot capacity to 3,490,000 net tons annually.

Steel shortages in Canada are acute, and demand is steadily increasing. On top of this the United States is cutting down materially on steel exports to this country. These conditions leave but one alternative—expansion of steelmaking facilities.

Dominion Steel & Coal Corp. is lining up a large scale expansion program for its Sydney works. Other plans are afoot, too. Just how many furnaces the programs will include and what their location will be is not yet known. However, reliable sources report that provision will be made by the government in the forthcoming budget for the required expenditure.

This does not mean that the government will operate the furnaces under public ownership. Instead it will lease them to Canada's large steel companies. Eventually the operators will have the opportunity to purchase the stacks from the government, it is felt.

The proving of some 300 million tons of high grade iron ore in the upper Quebec-Labrador region by the Hollinger Co. and the M. A. Hanna Co. was one of the major developments of the year. This is by no means the total magnitude of the reserve but merely the known minimum. This region will take on added significance in years to come since steel men in the United States are frantically running the globe searching for reserves that can be made available in case of national emergency or when the Mesabi range peters out in the future.

Australia: Ingot output here is well above the prewar level, but some 500,000 tons short of the 1.9-million ton peak in 1942. Currently, heavy industry has two serious problems to combat—coal and manpower shortages. The union movement is very strong here and the frequency of strikes has greatly hampered the coal, power and gas industries, particularly coal.

Many new light industries have developed in recent years. Because of their cleaner working conditions and higher wages that result from the keen competition between them for workers, labor is drifting away from heavy industry in alarming numbers.

To maintain its labor force, D.P.'s are being transported here under a government scheme and trained for heavy industrial work. Neither is it uncommon for searches to be made for workers in England and their passage-paid to this country.

In the meantime the Broken Hill Proprietary Co. has two large expansion programs lined up. They are going to put in hot and cold strip mills with a capacity to roll 1 million tons of ingots a year at the Port Kembla works. An additional $30 million expenditure has been authorized for an iron ore extraction plant on Cockatoo Island, a new battery of 48 coke ovens at Port Kembla and a 10-in. rod and merchant mill at the same plant.

Italy Produces 2.4 Million Tons

Italy: The Italian steel industry is slowly but surely recovering from the war. Production of ingots and castings is estimated at 2.4 million tons for the past year, just short of the prewar high. To add to this, a clear cut defeat of the Communists at the polls early in the year has added stability to the labor outlook.

In 1947 Italy imported about 300,000 tons of scrap. Last year this item ran almost 800,000 tons. Thus, despite raw material shortages, additional use of electric furnaces has enabled her to continually increase steel output.

Automobile manufacture has made excellent recovery since the war. Production has risen from practically nothing in 1944 and 1945 to about 50,000 cars in 1948. Despite the fact that there is reasonable demand for passenger cars here, sales have lagged. To partially combat this condition, the Fiat Co. has been making farm tractors in plants formerly used to make trucks.

Rolling mills are in poor condition. Extensive modernization work is in progress. To reflect the situation, canning, the country's big industry, got only about 30,000 tons of tinplate last year. It could use about 160,000 tons annually. When modernization is completed in 1951, it hopes to be getting just about that amount.

steel capacity

U. S. steelmaking potential was increased 2,350,000 tons in 1948 by a judicious combination of new melting equipment and technological improvements. An additional 2,744,000 tons will be available by 1950. The author lists the new facilities and tells how industry has been utilizing new production ideas to the utmost in an effort to combat the hurdles of present expansion plans, not the least of which is the abnormally high cost of equipment.

By G. F. SULLIVAN
Pittsburgh Regional Editor,
THE IRON AGE

During the past year American steel companies added new melting facilities rated at 1,088,000 net tons of ingots, on an annual basis, and made other improvements that totaled an additional 1,262,000 tons annually. New melting furnaces rated at 1,644,000 tons annually will be installed during 1949, while other programs will step up the industry's ability to produce ingots in 1949 by at least another 1,100,000 tons a year. Total gain in capacity for the 2 years will be 5,094,000 net tons.

These improvements and new facilities will permit the industry to make approximately 94 million tons of ingots in 1949. This is more than 5 million tons better than 1948 production of about 88.5 million ingot tons. This astonishing gain cannot of course be scored if there are labor troubles comparable with the 1948 coal strike that cost the country 1.6 million tons of ingot output.

The rated ingot capacity of the industry as of Jan. 1, 1947 was 90,902,-180 net tons. This was increased to 93,922,340 tons as of Jan. 1, 1948. If the entire 1948-1949 increase in steel producing ability (the 5,094,000 tons referred to above) could be translated into rated capacity and added to the Jan. 1, 1948 figure, the industry's capacity on Jan. 1, 1950 would be 99,016,-000 tons. But this involves two assumptions: (1) That, on Jan. 1, 1948, the industry could actually produce at its rated capacity; and (2) that the 5,-094,000 tons all represent an increase in rated capacity. Neither of these assumptions is true.

Many steel companies could not operate at 100 pct of actual rated capacity during 1948 despite the insatiable demand for their product. Therefore, the Jan. 1, 1948 rated capacity figure was too high. It was too high because while the facilities to make that much steel were on hand, the raw materials problem prevented it. Unexpected difficulties with equipment that had been pushed harder for longer than ever before also held output down.

Therefore, while the new melting facilities either have been, or will be, included as net additions to the rated capacity of the industry, this cannot

New Steelmaking Capacity Planned for 1948-49

1948 Additions

Company	Number of Furnaces	Rated Capacity per Heat (N.T.)	Annual Capacity (N.T.)	Plant Location	Furnace Builder	Operation Started	Remarks
ELECTRIC FURNACES:							
Armco Steel Corp.	1	60	72,000	Butler, Pa.	American Bridge	Feb.	
Armco Steel Corp.	2	70	180,000	Middletown, Ohio	American Bridge	April	
Copperweld Steel Co.	1	50	100,000	Warren, Ohio	Swindell-Dressler	May	
International Detrola Co o.	1	60	90,000	Newport, Ky.	American Bridge	June	Inactive since war
Rotary Electric Steel Co.	1	60	90,000	Detroit	Pittsburgh Lectromelt	Dec.	
Bethlehem Pacific Coast Steel Corp.	1	50	84,000	Los Angeles	Pittsburgh Lectromelt	Jan.	
Central Iron & Steel Co.	1	25	42,000	Harrisburg, Pa.	Moved and rebuilt	Oct.	15-ton moved from Harrison, N. J.
Crucible Steel Co. of America	1	25	30,000	Midland, Pa.	Moved and rebuilt	Oct.	15-ton moved from Harrison, N. J
TOTAL ELECTRIC FURNACE			688,000				
OPENHEARTH FURNACES:							
Kaiser Co., Inc.	1	185	120,000	Fontana, Calif.	Loftus Engineering	Dec.	
Jones & Laughlin Steel Corp.	1	175	100 000	Cleveland	Loftus Engineering	July	
Penn-Ohio Steel Corp.	2	75	100,000	Birdsboro, Pa.	Enlarged	July	Inactive 50-ton units leased from U. S. Navy and enlarged
Ford Motor Co.	2	185	218,600*	Dearborn, Mich.	Loftus Engineering	Oct., Dec.	Replace 2 110-ton units. Total net capacity increase 80,000 tons
TOTAL OPENHEARTH (NET INCREASE)			400,000				
GRAND TOTAL FOR 1948			1,088,000				

1949 Additions

Company	Number of Furnaces	Rated Capacity per Heat (N.T.)	Annual Capacity (N.T.)	Plant Location	Furnace Builder	Operation to Start	Remarks
ELECTRIC FURNACES:							
Allegheny Ludlum Steel Corp.	2 2	70 60	400,000	Brackenridge, Pa.	Swindell-Dressler Move and rebuild	May Aug.	2 50-ton units being moved from Hays, Pa., and enlarged
McLouth Steel Corp.	2 2	60 60	360,000*	Trenton, Mich.	Move and rebuild American Bridge	Jan., Feb. Apr., May	1 35-ton rebuilt, 1 60-ton both being moved from E. Chicago, Ind. Total net capacity gain 240,000 tons
International Detrola Corp.	2	60	180,000	Newport, Ky.	American Bridge	March	
Rotary Electric Steel Co.	1	60	90,000	Detroit	Pittsburgh Lectromelt	March	
Oregon Steel Mills	1	12	36,000	Portland, Ore.	Pittsburgh Lectromelt	Jan.	
Southwest Steel Rolling Mills	1	9	30,000	Los Angeles	Pittsburgh Lectromelt	Jan.	
TOTAL ELECTRIC FURNACE (NET INCREASE)			976,000				
OPENHEARTH FURNACES:							
American Steel & Wire Co.	2	160	240,000	Duluth			
Ford Motor Co.	1	185	109,300*	Dearborn, Mich.	Loftus Engineering	Jan.	Replace 1 110-ton unit. Net gain 40,000 tons
Empire Steel Co.	1	140	88,000*	Mansfield, Ohio	Loftus Engineering	March	Replace 100-ton with 140-ton unit. Net gain 28,000 tons
TOTAL OPENHEARTH (NET INCREASE)			308,000				
BESSEMER CONVERTERS:							
National Tube Co.	3	25	918,000*	Lorain, Ohio	Pennsylvania Engineering	March	Replace 2 13.4-ton units. Net capacity gain 360,000 tons
TOTAL BESSEMER CONVERTER (NET INCREASE)			360,000				
GRAND TOTAL FOR 1949			1,644,000				

* Not a net gain, see "Remarks"

be said for the technological improvements and other gains. For many companies these improvements will do nothing more than permit them to operate at or closer to rated capacity; for a few others they are actually net increases in steelmaking capacity.

Current programs aimed at bettering raw material supply and refurbishing equipment should make rated capacity an attainable goal later this year or in 1950.

On an annual basis, the new melting furnaces installed in 1948 include 688,000 tons of electric furnace capacity, or 63 pct of the new total. The remainder, a net gain of 400,000 tons, was openhearth. Increased use of electric furnaces to melt low carbon steels, rather than the alloy steels upon which their rating was based, actually increased their capacity during 1948. This has been very conservatively estimated at 200,000 tons on an annual basis. All the new electric furnace capacity, both 1948 and 1949, will primarily be used to melt low carbon steel except one 60-ton Armco unit and a rebuilt 25-ton Crucible Steel Co. furnace.

For 1949, electric furnaces will account for a net increase of 976,000 tons, or 59 pct of the new capacity. There will be a 308,000-ton net gain in openhearth and a 325,000 ton increase in bessemer converter capacity.

Two things explain the high percentage of new electric furnaces: (1) They are the fastest way of increasing ingot capacity at the lowest investment per ton; and (2) most openhearth operators are concentrating on getting better output from existing facilities.

The large steel companies are spending far more on raw material improvements than they would have to lay out for a million or more tons of new melting capacity. Along with boosting steelmaking ability these technological improvements will cut costs. It is a process of putting the house in order to meet demand now and be in a better competitive position when orders decline.

New Capacity Estimated

Most of the estimates of new capacity and other gains are conservative because it is generally impossible to predict exact output. All 1949 estimates are for equipment being designed or built now. None were made on plans still in the talking stage. Over 1,500,000 tons of new capacity is being considered for installation in 1950 and 1951 and further technological gains are expected in those years. However, these plans are not included in the figures given here. Neither is there any inclusion in these figures of acid openhearth furnaces originally built for steel castings and relined as basic openhearths to produce steel ingots on conversion arrangements.

During 1948, production of finished steel products now in tight supply was out of balance with ingot capacity by at least 2,500,000 tons. This is a conservative estimate of the amount of steel that moved on "conversion" arrangements during the past year. Some sources place the figure closer to 3 million tons. At any rate, between 2,500,000 and 3 million tons of ingots were poured at plants that did not have the facilities to convert them into sheets, strip, plate, pipe or tubing—the high-demand items. For 1947 it is estimated that approximately 850,000 net tons of ingots were sold for conversion by other producers.

This indicates that despite what some so-called authorities would lead the public to believe, ingot capacity in itself is not the full measure of the ability of the steel industry to meet customer demand. No one realizes this better than steel company officials. It explains why the bulk of the money spent or earmarked for expansion and improvements is going into auxiliary facilities, not into the purchase of melting furnaces. The U. S. Steel program is a case in point. Big Steel's bill for expansion and modernization in projects now more than half completed will total $950 million. Yet it will add only 600,000 net tons of new melting capacity during 1949.

Better Coal Supplies Vital

Why this relatively small capacity addition in such a huge program? For higher production at a lower unit cost, U. S. Steel officials believe in better utilization of the facilities they now have. Like all other steelmakers, they have not been getting the production they should from their blast furnaces. By improving the quality of coke charged to these furnaces, by reducing ash and sulfur, they can get more hot metal of a quality that can be melted in the openhearth in less time per heat. The addition of a lot of new openhearths—without adding blast furnaces—would serve no useful purpose. Whether blast furnaces can or should be added now in any expansion program is a more complex question which will be discussed later.

One result of the U. S. Steel program is that it will be able to produce almost a million more tons of ingots during 1949 because of better coal from its Robena, Pa., and Gary, W. Va., mines. Finishing facilities throughout the corporation are also being substantially improved. For instance, at Carnegie-Illinois' Irvin Works an improvement program estimated to cost at least $20 million is nearing completion. It is a completion of the technological revolution in sheet production from hand mills to continuous cold rolling mills. It will reduce costs and boost production by about 10 pct there, suppying more of the type of sheets now in demand.

Jones & Laughlin Steel Corp. has a similar story. With an exceptionally fast cold reducing mill at Aliquippa, the auxiliary equipment can't handle all it will put out. Raw material supply can't keep pace either. So the hot mill that supplies the big Aliquippa cold mill will be stepped up. Then to handle the higher cold-reduced strip production, finishing facilities at Aliquippa will have to be increased.

Without overlooking the obvious importance of finishing facilities it is a fact that ingot capacity has normally proved a useful indication of the ability of a company or of the industry to produce steel. This is because steelmakers try to foresee the types of steel that can be sold and add to

their melting capacity the finishing equipment needed to roll it. Insatiable postwar demand upset their previous calculations. But present construction programs of the steel industry, totaling about $2 billion, will go far toward providing the type of finishing equipment needed for a better balance of raw steel and finishing facilities. Ingot capacity will then be a more accurate measure of the industry's ability to deliver the types of steel the customer wants. Meanwhile, for lack of any better yardstick it will continue to be used because ability to produce is harder to measure.

The term "capacity" has been lightly used during the past few years. What is meant is "rated ingot capacity." By definition the rated capacity of each furnace—and hence of the industry—is based on a reasonable estimate of the ingot tonnage that furnace will produce. This estimate is based on past performance. It is modified if necessary by any major change in the type of steel being melted, also based on experience. Changes in raw materials, auxiliary equipment and in product mix affect production. Capacity is not always revised as these changes occur. This explains why some furnaces are not producing at their rated capacity—at the tonnage output that past records show they should be producing.

Behind ingot melting capacity is the blast furnace, at least when one considers a 5 to 10 million-ton expansion of capacity. Where to put the furnace? On the Great Lakes, which will probably run out of high grade ore long before the furnace is worn out? On the East Coast to use foreign ores, the date of arrival of which is still uncertain? In the West? What will be the analysis of the ore and coke used by the furnace so that it can be properly designed?

Then there is the basic problem of locating a plant so the raw materials can be assembled at a reasonable cost. This ties into the question of the distance of the mill from the market it intends to serve—and markets are still in a state of confusion. Even such an apparent trifle as the cost of foundations required in the area selected is a factor.

Locating a big steel plant poses a nice national defense problem, too. It will be recalled that one of the first areas to which antiaircraft artillery was rushed at the outbreak of World War II were the locks at Saulte Ste. Marie. Through these locks moves the bulk of the iron ore upon which the American steel industry depends. If the locks were knocked out, as they could be by a single bomb (non-atomic), the ore needed to support wartime steelmaking could not be hauled by train without disrupting other war transportation. From the military and economic viewpoints, the St. Lawrence Seaway would alter the midwestern ore supply picture, somewhat reducing the critical nature of the Soo locks.

The matter of financing is critical for an industry that is currently chewing into profits to pay for current expansion and modernization programs. One government source admits that steels depreciation charges today are "quite inadequate to replace physical assets." This, combined with a low rate of return on invested capital, leaves the industry in poor shape to sell stocks or bonds.

Let the Reconstruction Finance Corp. finance new capacity, says C. Girard Davidson, Assistant Secretary of the Interior. If steelmakers reject RFC loan's "because of their basic opposition to expansion, then Government itself must build the steel plants as it did during the war," he declared. Mr. Davidson's views are shared by others in Washington.

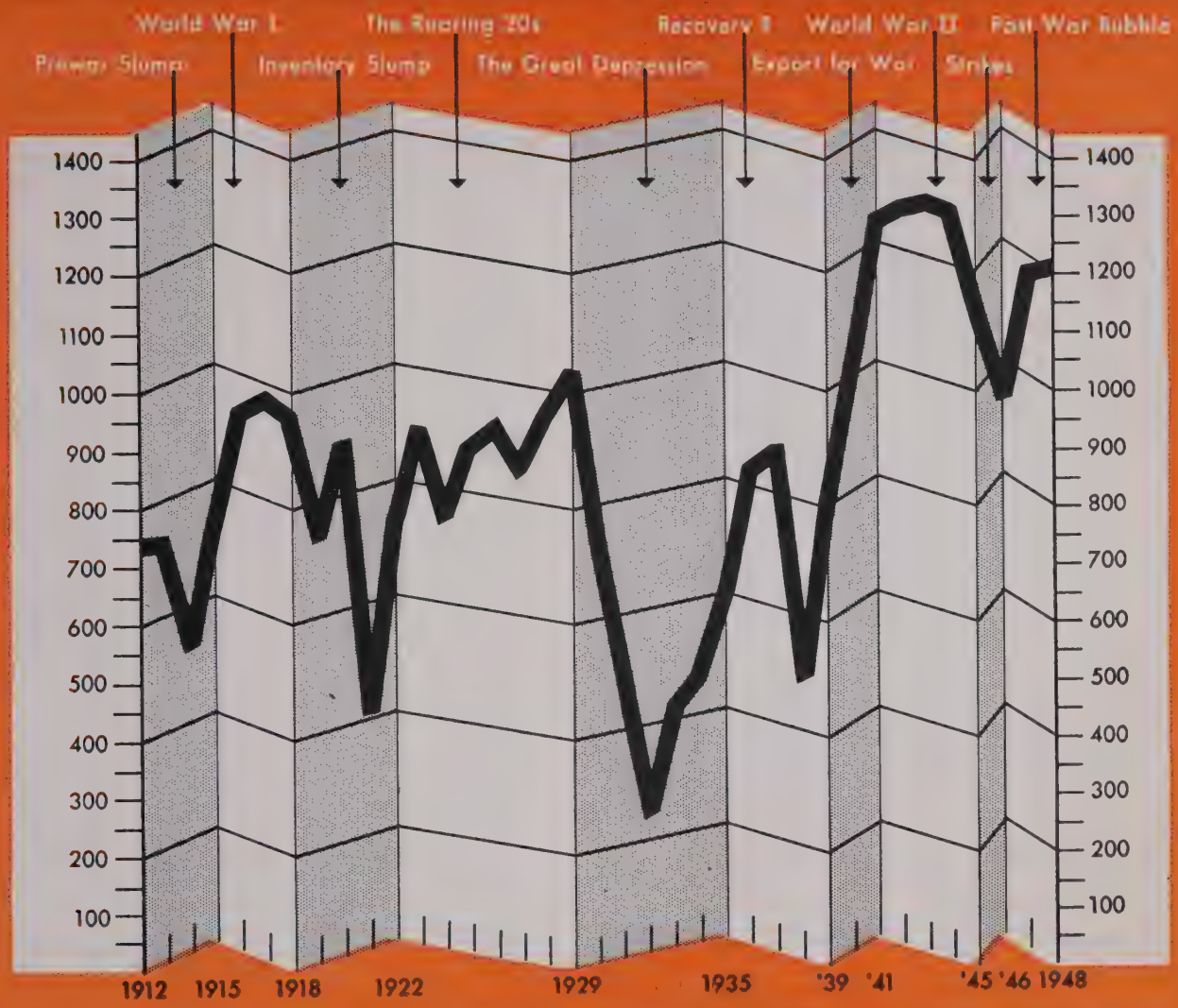
Supposing a group of experienced steel men were to form a company to build a completely integrated plant rated at 2 million ingot tons to produce sheet and pipe. The cost of such a plant has been estimated at $300 a ton, or a total of $600 million. Assume the money could be borrowed at 3½ pct interest and that the investment were amortized over a 20-year period. Interest charges would be $21 million a year and amortization $30 million a year. These two items total $51 million annually. The new steel company should at least earn the same rate of return on its invested capital as other companies in the industry. That figure happens to have been the lowest, in 1947, of any major industrial group. It may also be assumed to have the same labor, raw material and maintenance costs. It would probably be more efficient, on paper. But the efficiency gain would be offset for some time by the normal difficulties of breaking in new management with new labor on new equipment. By that time the rest of the industry would probably have installed new equipment and caught up in efficiency. In other words, it may be assumed that the only important difference in costs between this imaginary new plant and a going plant of comparable size, production, etc., is the amount of capitalization. The average capitalization of the steel companies of the United States in 1947 was approximately $52 a ton.

A 2 million-ton going plant capitalized at $52 a ton would represent a capital investment of $104 million. Depreciation on this plant on a 20-year basis would be $5,200,000 a year. Interest at 3½ pct would come to $3,640,000, for a total of $8,840,000.

Assume that both the old and the new plants produced 1,600,000 tons of finished steel a year. To offset interest and amortization the newly built plant would have to charge against its annual steelmaking cost an item of $51 million divided by 1,600,000 or $31.88 a ton. But it would be competing against plants that have to charge against their steelmaking costs a figure of only $5.53 a ton ($8,840,000 divided by 1,600,000). In other words, to earn the same rate of return on its investment the new plant would have to charge the difference between $31.83 and $5.53, or $26.35 a ton more for its finished steel.

Private capital for such a venture would be unobtainable because such a price differential—or even a twentieth of such a differential—would close the new plant in competitive times. And operators of such a plant, with RFC money, though perhaps at a lower interest rate, might wind up in the same fix as Henry J. Kaiser. He finds he has to charge $30 a ton above the market (while he can) in order to write off some of the

PER CAPITA STEEL INGOT OUTPUT IN U.S.A.



high cost of his Fontana operation. How much time he has to effect that write-off remains to be seen.

There are gains ahead for the industry from new and better processes—technological improvements. Some can be measured from experience, many can not. So steel men are cautious about basing higher capacity estimates on some of the work now in progress. There are at least three reasons they don't like to base too many predictions on technological gains: (1) Many of the gains registered during the past few years have been offset by declines in coal and scrap quality; (2) new techniques require study of operating records over a relatively long period before their overall effect can be calculated; (3) almost all the estimates of tremendous and immediate production increases from oxygen use have so far proved too optimistic, but it took a year or so to discover the fact.

Heading the list of things that are increasing ingot capacity is coal washing. In October 1948 U. S. Steel started a huge washer at Gary, W. Va., that produces 20,000 to 23,000 tons of washed coal daily. This coal goes to its plants in the Chicago district where the improvement is reliably reported to have already added at least 500,000 tons to that area's steelmaking potential. The first washing unit at the corporation's Robena (Pa.) mine is due in soon and is expected to produce 10,000 tons of washed coal a day. In all, better coal will give U. S. Steel about a million tons more steel in 1949 in the Chicago district alone. Almost all of the steel companies that operate their own coal mines have installed or are installing coal washing equipment. They have been squeezed between exhaustion of higher quality coals and the increase of mechanized (or non-selective) mining. Coal washers remove impurities to make better coking coal. Coke quality will be improved over what it has been during the past few years though it is still worse than it was before the war.

No single development during the past year got more attention than Republic Steel Corp.'s reports on high top pressure blast furnace blowing. A company official has reported to THE IRON AGE that the new technique added 105,000 tons

to blast furnace capacity in 1947 and an additional 75,000 tons to that figure during 1948. These calculations, he said, are conservative. For 1949 and 1950 the additional increases expected are 75,000 and 105,000 tons respectively. Five Republic furnaces have been converted to high top pressures and two more are scheduled. It is possible, say Republic engineers, to get as much as 20 pct more iron from a furnace using this practice. Typically, a 1275-ton a day furnace can be stepped up to 1500 tons a day.

Up to a point, each ton of hot metal that replaces scrap saves melting time in the openhearth. For some companies, pig iron increases merely help the openhearth superintendent in his struggle to get the rated capacity out of his furnaces. For others somewhat differently situated, more hot metal means actual additions to openhearth capacity.

Last year's pig iron output was only a few percent better than it was in 1947 but about 15 pct more purchased scrap was charged to furnaces. Had these ratios been reversed and additional hot metal charged instead of scrap, ingot output would have been substantially better in 1948. Home scrap consumption was about the same in both years.

Oxygen as a tool for boosting output lost a little face during the past year. Now it is coming back quietly, on a more scientific basis. National Steel Corp.'s bulk oxygen plant at Weirton, originally slated for completion in 1948, is still several months away. Until some results are reported from Weirton, the National Steel Corp. estimate (in 1947) of a 500,000-ton ingot capacity gain from use of oxygen is being excluded from new capacity estimates for 1949. Bethlehem Steel Corp., reporting no prospective ingot capacity increases for 1949, is apparently not counting on the bulk oxygen plant and experimental setup at Johnstown for anything definite in 1949. At Republic, oxygen in the openhearth and electric furnaces is still in the experimental stage, with universal application limited by oxygen cost. The company calculates however that it got 185,000 extra tons of ingots by this means in 1948. In 1949 it may be increased by an additional 200,000 tons, and again by 200,000 in 1950, Republic engineers estimate. These are cumulative gains, that is the 1948-1949 increase is 385,000 tons.

Alloy and stainless steel melting time and quality have both been improved by use of oxygen. By reducing time per heat it has boosted capacity. For the industry as a whole the gain is substantial but most shops prefer not to talk about it. They feel that if they have scrap trouble or power shortages the oxygen gains will serve as a cushion. Republic's gains have been due primarily to use of oxygen for carbon reduction. Allegheny Ludlum reported "substantial" increases in 1947 using oxygen almost entirely for carbon reduction and anticipates a little more gain in 1949.

Faster charging of openhearths and electric furnaces is another promising field for capacity gains. This will require faster cranes, bigger and speedier charging machines and larger charging boxes and furnace doors. Engineers working in this field say that 1 to 1½ hr can be cut from the time required per openhearth heat by better material handling. Better scrap preparation is another angle on which some companies are working to reduce melting time.

Steel capacity will continue to be a political football just as long as everyone can't get all the steel he wants. When steel begins to come out of everyone's ears—and that date is getting closer—the subject will go into hibernation to emerge when, as and if there is a sharp recession. Then it will be revived with the knife blade turned the other way: Too much capacity.

Steel demand would plummet if prices were doubled. One reason steel is in tight supply now is that its price (including extras) has risen less than most other commodities. The steel "shortage" could have been snuffed out long ago if prices had been boosted to gray market levels. For their own selfish interest, which is also the common interest, steel men don't want knowingly to price themselves out of the market. They want to make money tomorrow, too. An expensive program of expansion based on the figures cited by some of the planners would certainly wreck tomorrow's market. There are enough threats to steel prices without steelmakers going out of their way to commit suicide.

The postwar revival of the steel capacity argument began in 1947 on the heels of a steel-demand prediction that bore the stamp of approval of the American Iron & Steel Institute. It was made by Wilfred Sykes, president of Inland Steel, and set 1950's steel needs at about 76 million ingot tons. Washington officials and labor leaders raised a howl because even then there was an active steel gray market. A quick check of the Institute membership disclosed that acting independently and without fanfare American steel

Steel Capacity Increases for 1948 Due to Technological Improvements

Company	*Gain (N.T.)*	*Improvement*
U. S. Steel	500,000	Coal washers; new blast furnaces.
National Steel	200,000	Increased hot metal from bessemers; improvements in openhearth shops.
Republic Steel	185,000	Oxygen, primarily for carbon reduction.
Wheeling Steel	127,000	Additional hot metal from rebuilt furnaces; new coke ovens.
Armco Steel	10,500	Improvements in melting shops.
Colorado Fuel & Iron	40,000	Additional hot metal facilities at Buffalo.
Additional electric furnace capacity	200,000	Based on wide use of electric furnaces to melt low carbon rather than alloy steels.
TOTAL	1,262,000	
1949		
U. S. Steel	500,000	Added coal washing facilities.
Republic Steel	200,000	Oxygen.
National Steel	200,000	Improvements in openhearth shops.
Wheeling Steel	120,000	Additional hot metal facilities; oxygen.
Youngstown Sheet & Tube	80,000	Coal washer.
TOTAL	1,100,000	

ONE of the newer techniques being developed to increase the output of blast furnaces is the use of high top pressures. This furnace at Warren, O., is one of several Republic Steel furnaces which have been adapted for operation with high top pressures.

producers were then planning 2,500,000 tons of postwar capacity expansion. This figure was periodically revised up to 5 million tons as new programs were decided upon. But the clamor did not cease.

The 2,500,000-ton expansion did not suit economist Louis H. Bean, assistant to the Secretary of Agriculture. In June 1947 he predicted unemployment if somewhat more than 100 million tons of ingots were not available in 1950. The Bean theory immediately appealed to several members of the Congress and apparently to several labor leaders, who demanded an immediate 10 million-ton expansion of capacity. On Jan. 1, 1947 steel capacity was 90,902,180 net tons of ingots.

Dr. Bean cited a Labor Dept. Full Employment Pattern study that set 1950 steel ingot needs at something between 98 and 122 million tons. He mentioned this to show that various estimates are partly due to differences in method and partly to differences in the art of analyzing statistics —and perhaps to show that economics is an inexact "science."

Dr. Bean's prediction was taken apart piece by piece for the American Iron & Steel Institute by U. S. Steel economist Bradford B. Smith. Mr. Smith's work is a masterpiece of statistical satire. He accused Dr. Bean of various statistical errors, including choosing only peak years to project his trend. Dr. Bean had pointed out that early in 1947 U. S. Steel Corp., on the basis of 1920-1940 experience, (during which it averaged 63 pct of capacity) saw a long term outlook for use of two-thirds of its capacity. This is equivalent to total industry production of about 63 million ingot tons annually. The Smith charts project 1950 demand at between 59 and 72 million tons. Dr. Bean countered (THE IRON AGE, Aug. 5, 1948, p. 104) and Mr. Smith again replied (THE IRON AGE, Aug. 19, 1948, p. 142). There this tiff rests.

Attacks upon the industry from Washington came as recently as December 1948 from Assistant Secretary of the Interior C. Girard Davidson and Rep. Wright Patman (D., Tex.). Mr. Davidson said that while the industry was planning to expand by 3 million tons during the next 3 years, demand would be three times that, if not more. It was in this tongue lashing that Mr. Davidson suggested the RFC loans referred to previously. Rep. Patman is demanding another steel mill in Texas.

To attack "the industry" as such is a paradoxical absurdity. When it comes to planning capacity expansion there is no such thing as "the industry." Steel company executives can not legally get together to plan changes in capacity. Nor would they do so if they could. Further expansion depends on a host of things. In essence it will come if individual companies see a chance to make money on it—if they can pay for it and get the raw materials to supply it.

Meanwhile, few in the industry expect current high demand to last more than a few years at best. After that some well informed sources look for a dip to perhaps 70 to 75 million tons of average demand over the next 20 years. If this should come to pass there will still be continuing programs to replace obsolete facilities with new units.

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machining workpiece handling

Full exploitation of new cutting materials and new machine tool designs demands that the bottleneck of workpiece handling time be broken. Much has been done, as this article relates, in reducing this nonproductive time, but much more remains to be done. The author tells of the many pronged attacks on this problem now underway and records some of the more outstanding achievements in boosting output through reducing work-piece handling time.

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The advent of carbide cutting tool materials in the late '20's saw cutting tools surpass in efficiency and cutting capacity the machines on which they are used. Since that time there has been a continued effort on the part of machine tool builders to bring the working capacity of machine tools up to the metal-removal capacity of the tools. Much has been done by builders in the past two decades to increase the efficiency and production rates of machine tools. Yet, much still remains to be done.

This tremendous increase in the cutting capacity of modern materials, both carbide and high speed steel, has whittled down the actual cutting time in machining until today it represents only a relatively minor part of the production cycle. Just how much of the cycle is devoted to actual machining varies both with the age of equipment and the type of operation. In one case, where a large part of the plant capacity was devoted to milling, it was estimated that actual machining time was between 12 and 15 pct of the operating cycle. On this basis, in an 8 hr day, each machine operated on an average of only 53 to 72 min, leaving about 7 hr a day in idle machine time. This case is probably an extreme, but the idle time of machine tools, except in high production shops, far exceeds the cutting time.

What can be done about it? Aside from improvement in machine tools of standard types, one phase of machine shop operation that can be improved is the handling of work. Part of this involves the movement of parts from storage to the machine, between machining operations, and back out of the machining sequence to storage, to subsequent nonmachining operations, or to shipping points.

While intra-plant material handling is fundamental to a production plant, it is not always suited to job shop type production. Here, the work varies to such an extent that no particular timing sequence is of sufficient importance in the production cycle to warrant the special equipment to move parts, and only broad, general materials handling methods can be adopted. Consequently, in a job shop or in a shop where identical part production is numerically limited, the benefits of extensive materials handling systems

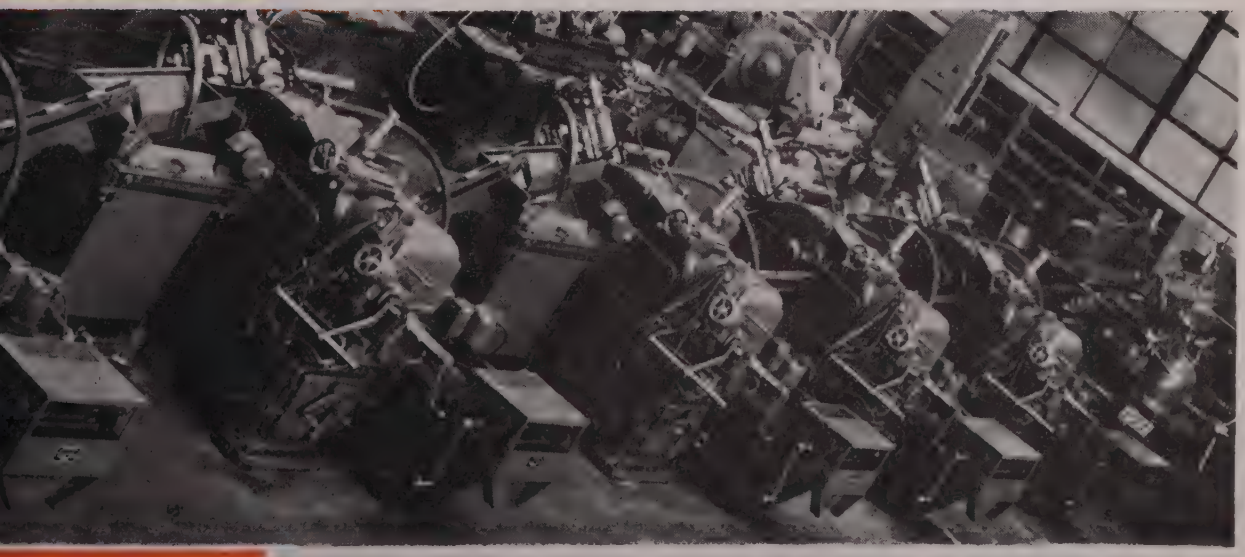


FIG. 1—The Warner & Swasey Electro-Cycle feature controls headstock speed and direction, reducing the nonmachining time of the cycle. Inset shows the control box for Electro-Cycle.

frequently do not justify the expense of installation. However, this does not mean that modern materials handling methods between operations should be completely ignored. Their adaptability should be carefully studied from the standpoint of the work at hand and the expense that such work will justify.

The second method of improved materials handling, more adaptable to the smaller type shop and just as economically sound to the large production shop, is right at the machine. This involves two phases: (1) Machine function control, including faster in-feed of tools, faster reversal of spindles, and more rapid manipulation of machine details during periods other than actual cutting, and, (2) the mechanical task of getting parts into position to be machined and getting them back out of the machine.

The first task is one for the machine tool builder. This has been studied by many builders, and, it appears, the maximum use of cutting tools is not yet possible because of the lag in development of machines, motors, and electrical, hydraulic, and mechanical equipment. Yet some builders have made certain limited advances in this direction.

Typical of such work done is the electrification of turret lathes by Warner & Swasey. To this end, Warner & Swasey has electrified three of its line, one for machining brass, nonferrous metals, plastics, rubber and the like, and the other two for machining ferrous alloys. In this line of machines, marketed under the trade name Electro-Cycle Turret Lathes and shown in fig. 1, spindle speeds, stops and directions of rotation are electrically regulated by a control box on the rear end of the lathe. Through this automatic drum control, all machine functions except tool positioning are directed. There is no problem of the mechanism getting out of synchronism and the turret may be back indexed, skip indexed or put through any changing sequence of operations without affecting the desired present functions. The use of self-opening die heads and collapsible taps on the machine is unnecessary from the standpoint of depth accuracy, because the spindle can be reversed within about ⅛ of a revolution of the same point each time.

By means of this automatic control, the headstock handling time is markedly reduced. On one selected part, this time reduction amounted to 50 pct. This reduced overall production time 25 pct or increased production 33.33 pct.

One of the main problems encountered in the design of this control was in obtaining an electric motor with sufficient reversal capacity. After 3 years of development work and testing, a NEMA frame 326, 5-2½ hp, 1800-900 rpm motor was selected. It was equipped with radial vent slots in the rotor and stator punchings, a hollow rotor supported on a magnesium spider and class B insulation. This oversize frame is necessary to dissipate the heat under rapid reversing service and also to produce the high starting and reversing torques necessary for short machine handling time. Inertia of the rotor is not a critical factor, since the inertia of machine parts is, in most cases, many times greater than that of the rotor.

Another standard type machine into which is built control features that speed production is the Bullard line of lathes with Man-Au-Trol, a system designed as a central control over the mechanical functions of the machine. It is available on the model 30H horizontal manifold lathe and on the six sizes of Cut Master vertical turret lathes. Through this electric-hydraulic control system, 39 different machine functions can be controlled. A 30-in. Cut Master vertical turret lathe with Man-Au-Trol is shown in fig. 2.

A drum control with stop dogs can be set to control the horizontal and vertical directions of feed and traverse, and through two slide wire stop arrangements, horizontal and vertical tool travel for each phase of the operation are accurately preselected. When in automatic cycle, changes of feeds and speeds for each of the various operations are set so that at the proper time for any change, the automatic feature changes the feeds and speeds. Speeds and feeds are independent of each other so that any combinations may be obtained.

The machines may be operated automatically or manually, and no cams are used in the control. In automatic cycle, the manual operation can be selected for a special job, and, when finished, automatic operation can be reset without disturbing the original setup. Once properly set up for automatic operation, all chances of human error are eliminated, and, in setting up, no trial cuts are necessary since the Man-Au-Trol is set up completely by measurement, rather than by cut and try. On one test machine that has been in practically continuous operation for 3 years, there has never been a reject for offsize or inaccuracy of a machined surface. Rate of production is automatically set at the maximum speed

of the machine, and in machining a limited number of pieces it has been found that the cutting speed often offsets the setup time.

The machine control method following the electric, hydraulic or electric-hydraulic type of control is the electronic type. One electronically controlled lathe has been developed by Warner & Swasey. Perhaps best known is the line of electronically controlled lathes built by Monarch Machine Co., Sydney, Ohio. Monarch has four such lathes, including the Speedi-Matic, Uni-Matic, the 13-in. Toolmakers' Lathe, and the Mona-Matic. Also, the company sells a packaged feed motor drive for engine lathes that is an electronically controlled, automatic cycle accessory.

While electronic systems to control power flow from an ac to a dc system have been in existence for a long time, improvements were necessary before they could be adapted to the control of mechanical-electrical rotating equipment. Monarch, after working with manufacturers of such controls, finally developed one essentially of its own design and suited to the control of Monarch lathes. These controls are flexible, certain and permit unlimited speed control of the machine, i.e., within the capacity of the motor, any desired spindle speed can be obtained. Control through potentiometers widens the usable feed range and maintains high torques at low motor speeds. The chief objection to electronically controlled machine tools is the cost, since the control itself is a major factor in the price of the machine.

One of the Monarch Mona-Matic lathe controls is the Air-Gage Tracer, a tracing device that permits complete automatic cycle machining with single-point, uninterrupted-cut turning. The cutting tool in a turning operation follows a tracer and, among other advantages, obviates the necessity of multiple tooling and is easy to set up. The Mona-Matic is shown in fig. 3.

The whole purpose of any such controls, electrical, electronic, or hydraulic, is to give better spindle control, greater power and wider flexibility in speed range, and generally, more flexible control at higher machine operating speeds.

Like the question of intra-plant material handling, however, the refinement of machine tool control—headstock, spindle, tool in-feed or other functions of the machine—requires heavy capital investments. The investment involves the purchase of new machines on which these controls are a part.

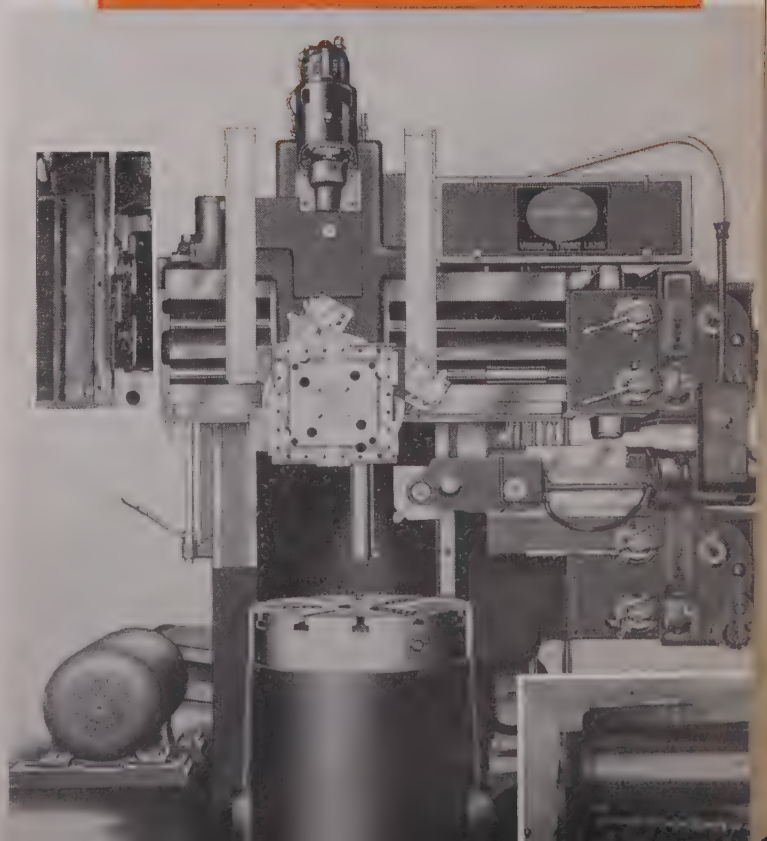
The second method of improved materials handling adaptable to the smaller type shop involves the mechanical task of loading and unloading the part in the machine once it is delivered to the operator. Before any major improvement program in a shop can be properly undertaken, some system of methods engineering must be applied. Methods engineering, while sounding somewhat involved, is, fundamentally, the elimination of waste of time, energy, and material in the production process. By means of analyses of operations and processes, existing conditions must be studied to eliminate any major inefficiencies.

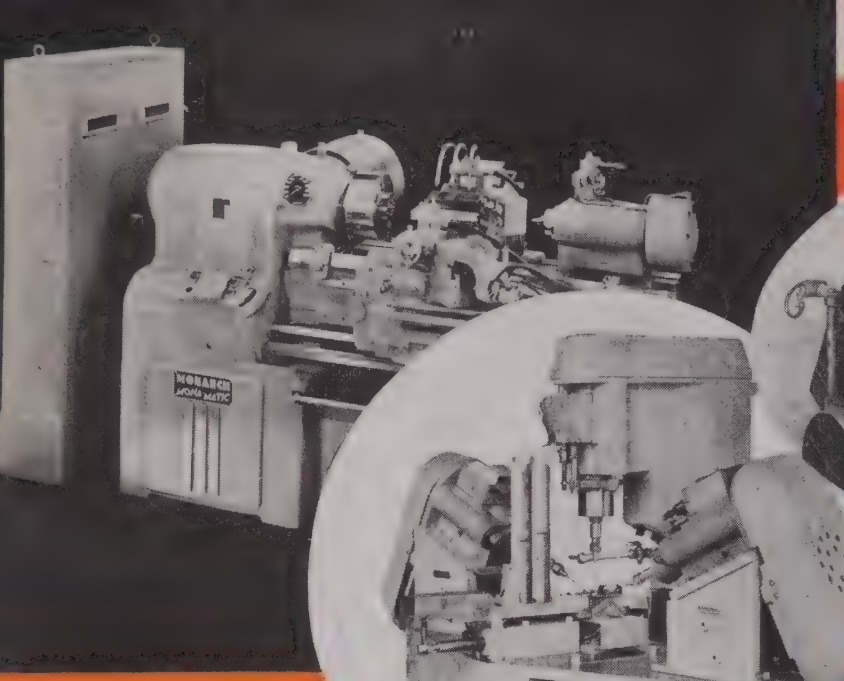
The time relationship between the operator and the machine must be examined to obtain complete information on how time is expended, both by the operator and the machine in a machine cycle. For example, while a machine is being loaded in a simple machine setup, the operator is working and the machine is idle. During the cutting cycle, the machine is working and the operator may be idle. During the unloading or cleanup, the machine is idle while the operator is working. When a machining operation is under control of the machine itself, the operator has considerable idle time. This sequence of machine and operator work and idle time can be easily plotted to determine just how both machine and operator time is spent, and how much of it is spent in each phase of the machine cycle. From the information obtained, better utilization of both operator and machine idle time can be developed.

From the standpoint of workpiece handling at the machine level, it is this idle machine time that is of primary concern. Reducing idle machine time is the aim of every production and job shop, since idle machine time is nonproductive time and nonproductive time is a dead loss. Yet, idle operator time, at present labor rates is also an expensive luxury.

In a machine cycle, a large percentage of the

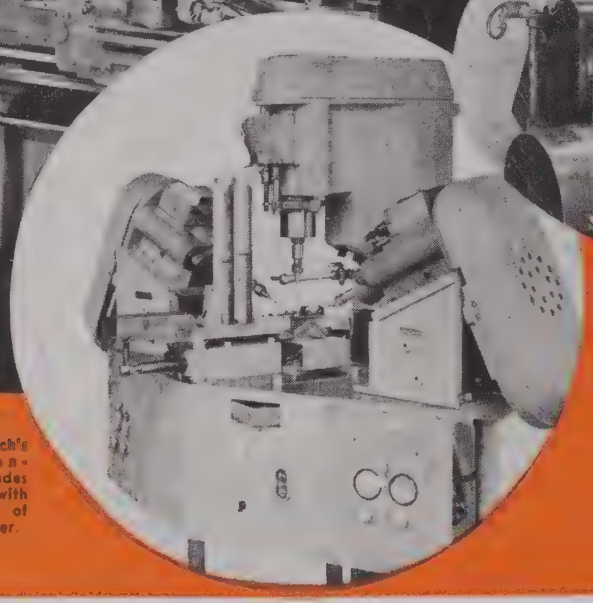
FIG. 2—This 30-in. Bullard vertical turret lathe is equipped with Man-Au-Trol, an electrically operated hydraulic feature that controls all functions of the machine. The lower inset is the control for direction of tool movement and the upper inset is for vertical tool distance control. Another wire control is used for horizontal tool distance.

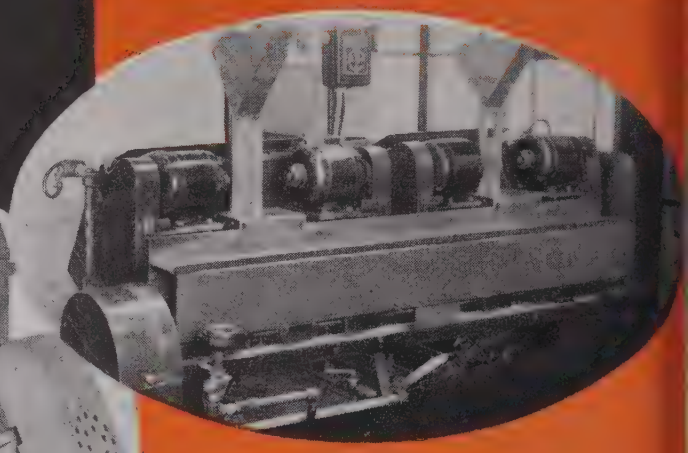




ABOVE

FIG. 3 — Monarch's electronically controlled lathes includes this Mona-Matic with the added feature of the Air-Gage Tracer.





ABOVE

FIG. 5—By mounting cutting heads on an old lathe bed, with a hopper feed and an air chuck between them, GE tool engineers had a high production unit for turning and chamfering the ends of short pins.

LEFT

FIG. 4—This "gadget" machine is a high production single purpose unit using an automatic work loading mechanism and standard drill heads.

cycle time is devoted to picking up the part to be machined, placing it in the machine, chucking it, unchucking it, taking it from the machine, and disposing of it. The cutting phase ranges from a low of about 10 pct to a high of about 60 pct of the cycle time. By reducing this workpiece handling time, production can be substantially increased. Since cutting time, through the use of heavier powered and constructed machines and better cutting tools, is already relatively low, less in the way of savings can be achieved by attacking the cutting time of the machine cycle.

Myron S. Curtis, asst. director of engineering of Warner & Swasey Co., Cleveland, recently outlined this task clearly and concisely. He said:[1]

"The productive capacity of any machine tool is controlled by two major factors. These are: (1) Machining time or time actually spent in the removal or forming of metal, and (2) handling time or time required to load and unload the workpiece, bring tools into position . . .

"The most marked improvements in machine tools have always been forced by the development and appearance of new cutting materials. The appearance of carbide cutting tools in 1928, together with improvements in the carbides themselves since that time and the development of techniques in the use of carbides have made people speed conscious. Some of the most striking illustrations of cutting speed possibilities are in the nonferrous metals and I am thinking particularly of the setup for bar milling during the war. As you know, airplane wing spars of aluminum were machined up to speeds of 12,000 sfpm and even at those speeds the maximum cutter capacity was not reached . . .

"Somewhere along the line, and I'll admit I don't know just where, there is a limit to the practical speed at which metal can be cut. Beyond that point it is much more important to pay attention to the decrease in handling time than it is to the increase in cutting speed."

This conclusion is further endorsed by the experiments of the Aluminum Co. of America in some machining research on aluminum and by the statements of John E. Lovely, vice-president of Jones & Lamson Machine Co., Springfield, Vt., before the 47th annual meeting of the National Machine Tool Builders' Assn., in Atlantic City, last October.

Mr. Lovely, in discussing the "Trends in Machine Tool Design," stressed the solutions of problems of automatic loading and handling in making and packaging cigarettes and in processing and canning of foods; the development of automatic handling and transfer in steel and tube mills; and speculated that the same principles and techniques should be applied to machining of castings and forgings. He stated that the tremendous increase in production by carbide tools and automatic cycling of simple machines has convinced many that great economies lie in this direction. Carbide tools, he said, have resulted in a decrease in cutting time of such degree that the other elements of time in producing work have become infinitely more important, and effort must be expended in designing machines to reduce handling and setup time and the manual labor involved in handling the large number of pieces machines are capable of producing.

Cutting speeds were investigated[2] by R. L. Templin, asst. director of research and chief engineer of tests for Aluminum Co. of America. An experimental turret lathe was developed with a spindle having an internal bore of about 2.5 in., which would operate at a maximum speed of

about 10,000 rpm. On this machine, 14S and 14S-T stock and 24S-T plate were machined dry at surface cutting speeds up to 20,000 sfpm, with no indication of an upper limit of tool cutting capacities being observed. As much as 470 cu in. of metal per min (about 47 lb) were removed. The limiting factor in the tests was the machine capacity.

Workpiece handling at the machine level divides itself into four classifications. First, complete automatic handling of the part prior to, during and after machining is accomplished through the use of the transfer or shuttle type machines. These machines have been adopted by production industries, including the manufacturers of automotive, refrigerator and other consumer products. Investment is high, but the production demand is high enough to justify the cost of procurement, installation and maintenance of such machines. Typical of such equipment are the machines which make up part of the engine-block machining line at Packard Motor Car Co.,[3] and the equipment that automatically handles and drills oil holes in Ford and Mercury crankshafts.[4]

The second classification of machine from a work handling standpoint is the special purpose machine. It is a single machine for a single or series of related operations on a single part or series of parts of similar shape, size and design. It is a complete operation in itself and may or may not be interconnected with other machines. The Snyder[5] drilling and boring machine for cross-shaft holes in a series of clutch housing is typical of this type of machine. The machine is a two-station unit, drilling at one station and loading, unloading and boring at the second. Through versatility in design of the work holding arrangement and the arrangement for varying the spindle speeds, this machine can be used in machining 76 different housings. While this would appear to take it out of the special purpose class, the parts are all of the same general shape and the center-distances between the tools is fixed.

Morey Machinery Co., Inc., Astoria, N. Y. recently designed an automatic lathe[6] for rough and finish turning railroad car axles. It incorporates a new end-drive chucking method to hold the axle by hydraulic pressure from the tailstock quill towards the headstock spindle. The complete machining cycle per axle takes between 2 and 3 min., depending upon size and operation, yielding about 200 axles in an 8 hr shift.

In such equipment, material handling into and out of the machine is part of the basic design, and many of these mechanisms are ingenious and excellent. However, because of the restricted application of such equipment, only production shops can justify its cost.

The third type of machine that is frequently adapted to automatic part handling is the tool engineer's *gadget* machine. This type consists of such combinations as a couple of drill heads mounted on base, some mechanism for loading, chucking and unloading the part. Typical of such machines is the drilling machine shown in fig. 4, designed by Voss Machinery Co., Pittsburgh, for General Electric Co., Erie, Pa. Circular parts are mounted into the two hoppers at left and feed across the table automatically, two at a time, under the drill heads. The upright head drills a hole between the abutting peripheries of the parts, forming a slot of half circle shape in each, and the other heads drill holes at an angle through the outside edges of the parts, one hole in each part.

The hopper fed setup shown in fig. 5 consists

FIG. 6—This rig on a Jones & Lamson 8-in. Fay automatic automatically loads, positions, clamps, unclamps and unloads the valve guide bushings shown in the inset. High-speed production is the result of this automatic handling, despite the fact that the machining time itself is not affected.

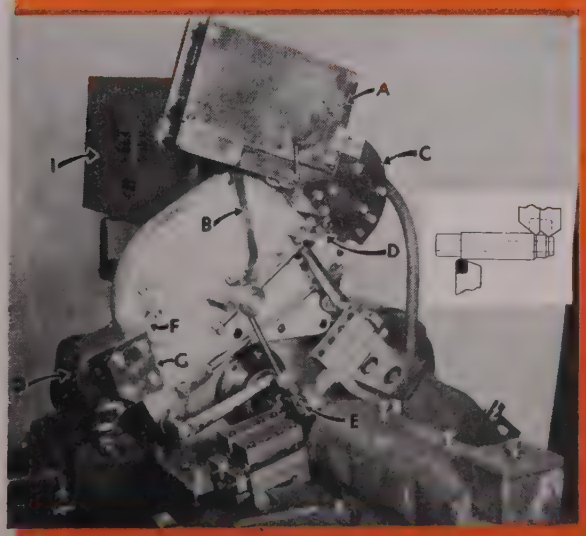
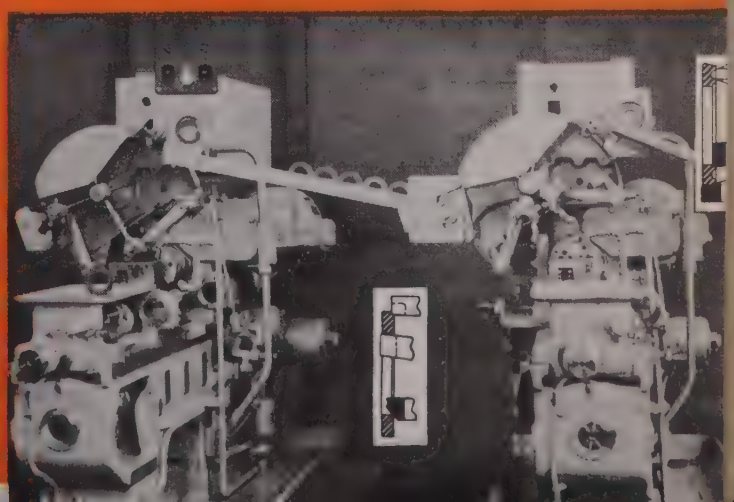


FIG. 7—Thrust bearing races are machined on both sides in this double lathe setup, using two 8-in. Fay's. The parts are loaded in the hopper of the machine at left and proceed through both machines by an automatic handling device. The first operation is shown in the inset at left and the second operation in the inset at right.



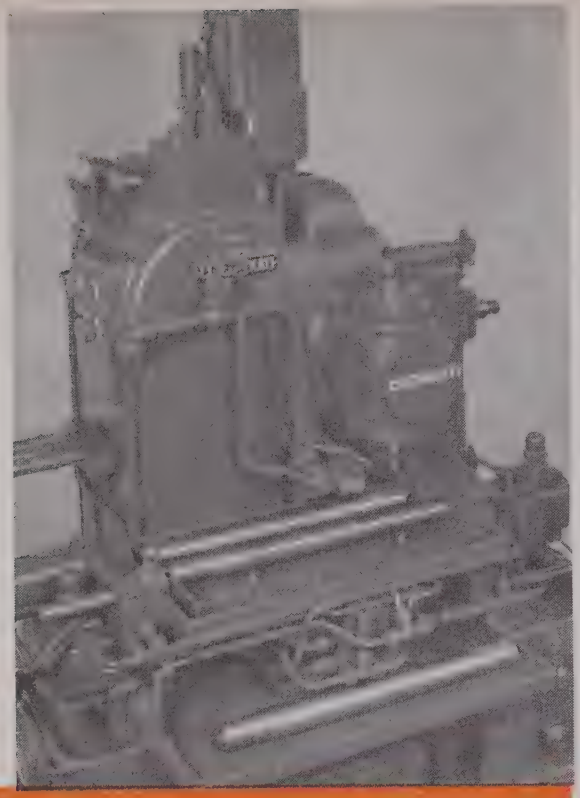


FIG. 8—A gravity feed to clamping position and automatic clamping place these parts for the milling head to drop into cutting position. After milling, the parts discharge through the fixture and out on to the lower tray.

essentially of two sets of opposed cutting heads mounted on an old lathe bed with a hopper feed mounted between each set and a vise under each hopper to catch single parts as they feed. As the vise jaws close, spindle cutters advance into position and turn and chamfer each end of the part. The operating cycle is cam-controlled. Each spindle is individually controlled by a motor. When the pin is machined, the spindles withdraw, the vise jaws open and the part drops into a container. This gadget is a high production machine, requires very little operator attention, and is automatic.

Again, because of the limited use of such equipment, it is not always adaptable to a short run production. Such equipment, while much lower in cost than the special purpose machines described, is actually special purpose equipment designed for production.

Finally, the adaptability of work handling devices to standard machine tools is the fourth classification. To the job shop, this offers the greatest potential in cost reduction. Machine loading devices designed for standard machine tools not only sharply increase production and reduce machining cycle time, but also permit greater use of semi-skilled and unskilled labor. As in many of the special purpose machine operations, it becomes merely the task of the operator to see that there are enough parts in the feeding mechanism to keep the machine in production.

For the sake of clarity, some of the methods of part handling will be discussed by the type of operation performed. Accuracy of hole location in drilling has been a problem since the early days of machine tool development and has resulted in the accumulation of thousands of dollars worth of jigs that have to be stored, maintained, and brought out for an occasional job. The Bullard Spacer eliminates costly jigs for drilling, boring, reaming and tapping, thus eliminating production, storage, handling, maintenance, and alteration costs on such jigs. The Spacer is a semi-automatic movable work table to which work is attached for positioning a multiplicity of predetermined locations. It is used with various types of radial drills. The table of the Spacer can be moved longitudinally and transversely, the distance of movement being controlled accurately by a system of hydraulic valves and cylinders.

The use of this Spacer on three specific jobs cut layout and machining time 34 pct, 31 pct, and 36 pct, respectively, in drilling 0.85 pct C and

FIG. 9—Lock barrels are loaded into this circular fixture and in six cutting operations are broached. The V slots in the fixture permit the broach to return to up position and the dog on the right of the tool holder ejects the part after the last cut to the top of the circular loading table, from which it is disposed of by chute into a tote box.

12 pct Cr steel. This was in addition to the savings in jig design, manufacture and storage. Another company reported overall savings of time alone amounted to 40 pct over previous methods. Once set up, the Spacer is accurate in hole location and sequence until purposely taken out of adjustment.

Excellent examples of part handling in turning operations are two loading and unloading fixtures developed by Jones & Lamson Machine Co., Springfield, Vt. An 8-in. high-speed Fay automatic lathe with automatic loading equipment, shown in fig. 6, was designed to perform a rectifying operation on the cast iron valve stem bushing shown in the inset. The job was to turn the OD true and concentric with the reamed hole and face and chamfer one end so that a definite length

limit would be maintained. The bushings are supported and turned on plug type centers that enter the reamed hole. To start the cycle, bushings are loaded into a removable magazine positioned above the working area. Two synchronized work handling arms, one for loading and the other for unloading, handle two workpieces during the handling cycle.

The loading arm *D* is in position in fig. 6 to pick up a new piece of work and the unloading arm *E* is in position to take a finished piece out of the work area. Arm *D* swings down to the loading position with a fresh piece as arm *E* moves to the stripping station *G* with a finished piece. All work motions are actuated by a single reciprocating motion of a cam-operated control rod.

The part magazine is shown at *A*, *B* is the agitator lever, *C* the loading position, *D* the loading arm with spring-operated fingers, *E* the unloading arm with spring-operated fingers, *F* the counting lever, *G* the unloading station, *H* the delivery chute, and *I* the control panel. Production on the job runs 600 pieces per hr, the material is cast iron, and 0.020 in. of stock is removed on a side. The machine data are: Spindle speed, 2500 rpm; feed, 0.030 in. per revolution; and cutting speed 450 sfpm.

Ball thrust-bearing races are completely machined in two operations using the two 8-in. Fay automatics with automatic loading and transfer, shown in fig. 7. The basic work loading and unloading mechanism is similar to that used for the valve stem bushing job in fig. 6. However, because of the need for a second operation, the position of work loading and unloading stations is just the opposite, this change allowing the piece from the first operation to be transferred by gravity chute to the loading station of the second machine.

FIG. 10—This sliding fixture positions five band saw blades for broaching of the teeth. The clamp in the foreground feeds the blades as the fixture retracts from cutting position.

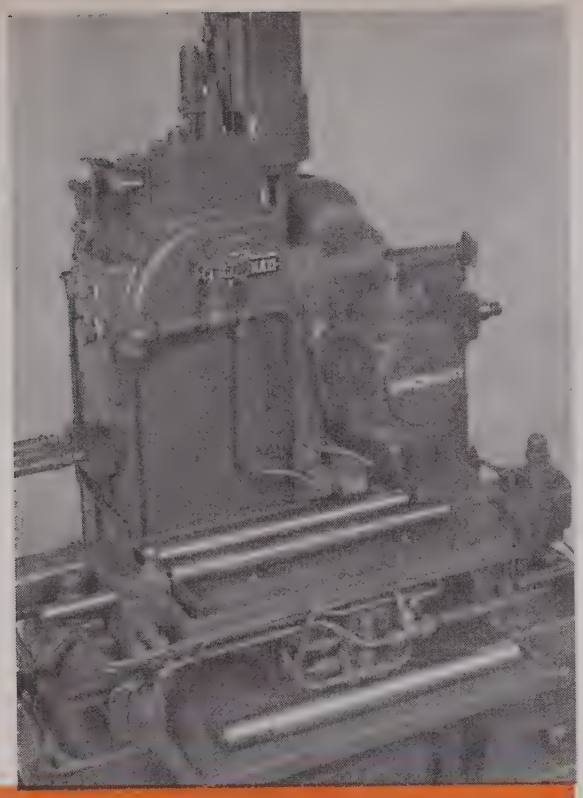
Rough pieces are stacked on edge in a horizontal trough with a spring-operated push-feed plate to keep the end piece in the first pick-off station. The work is transferred to the open chuck jaws, held by a pusher plate and clamped by the chuck. During this loading phase, the unloading arm removes the previous piece, raising it to the stripper station at the upper end of the gravity transfer chute. The pieces then flop over by their own weight onto a small curved ramp that leads to the loading station of the second machine, thus presenting the back of the part to the second operation tools. The handling cycle is repeated here and the parts are delivered by gravity to tote pans. All controls are automatic and safety devices prevent faulty performance.

Production totals 420 pieces an hr and the control panel is a dual type on a swinging arm. Each machine has individual stop, start and jog buttons. Machine data include: Spindle speed, 402 rpm; feed, 0.008 in. per revolution; and cutting speed, 338 sfpm.

Examples such as these are typical of how turning and boring machines can be adapted to automatic loading where production consists of small or medium sized parts. While these mechanisms are somewhat elaborate, adaptations and variations could be developed to suit specific purposes. Naturally, there is always the question of cost v. savings, and a common sense approach must be made to the problem so as to reach the optimum compromise between the additional cost involved and the savings that will accrue from the use of such devices.

Milling presents many opportunities for fast work handling. Multiple fixtures, where one is loaded and unloaded while another is in machining position, is one approach to the problem. Likewise, magnetic chucks and multiple chucks speed milling operations. Typical of multiple chucking is a keyway milling job developed by Rockford Magnetic Products Co., Inc., Rockford, Ill. Eight shafts are held magnetically while eight keyway milling cutters on a single arbor cut keyways in shafts. Such workholding tech-

FIG. 11—For headed parts where through-feed on centerless grinders is impossible, this in-feed arrangement can be used. Parts are stored in hoppers, lifted out on the track and fed into grinding position automatically. After the grinding cycle, the parts are disposed of by a gravity chute.



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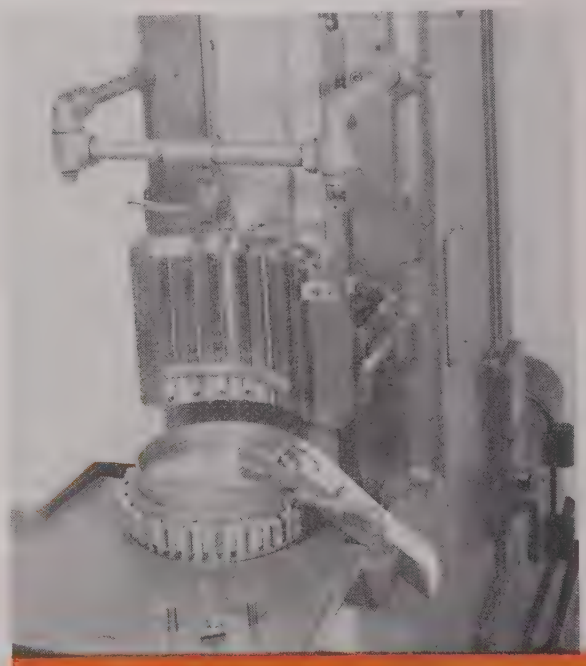

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12 pct Cr steel. This was in addition to the savings in jig design, manufacture and storage. Another company reported overall savings of time alone amounted to 40 pct over previous methods. Once set up, the Spacer is accurate in hole location and sequence until purposely taken out of adjustment.

Excellent examples of part handling in turning operations are two loading and unloading fixtures developed by Jones & Lamson Machine Co., Springfield, Vt. An 8-in. high-speed Fay automatic lathe with automatic loading equipment, shown in fig. 6, was designed to perform a rectifying operation on the cast iron valve stem bushing shown in the inset. The job was to turn the OD true and concentric with the reamed hole and face and chamfer one end so that a definite length

limit would be maintained. The bushings are supported and turned on plug type centers that enter the reamed hole. To start the cycle, bushings are loaded into a removable magazine positioned above the working area. Two synchronized work handling arms, one for loading and the other for unloading, handle two workpieces during the handling cycle.

The loading arm *D* is in position in fig. 6 to pick up a new piece of work and the unloading arm *E* is in position to take a finished piece out of the work area. Arm *D* swings down to the loading position with a fresh piece as arm *E* moves to the stripping station *G* with a finished piece. All work motions are actuated by a single reciprocating motion of a cam-operated control rod.

The part magazine is shown at *A*, *B* is the agitator lever, *C* the loading position, *D* the loading arm with spring-operated fingers, *E* the unloading arm with spring-operated fingers, *F* the counting lever, *G* the unloading station, *H* the delivery chute, and *I* the control panel. Production on the job runs 600 pieces per hr, the material is cast iron, and 0.020 in. of stock is removed on a side. The machine data are: Spindle speed, 2500 rpm; feed, 0.030 in. per revolution; and cutting speed 450 sfpm.

Ball thrust-bearing races are completely machined in two operations using the two 8-in. Fay automatics with automatic loading and transfer, shown in fig. 7. The basic work loading and unloading mechanism is similar to that used for the valve stem bushing job in fig. 6. However, because of the need for a second operation, the position of work loading and unloading stations is just the opposite, this change allowing the piece from the first operation to be transferred by gravity chute to the loading station of the second machine.

FIG. 10—This sliding fixture positions five band saw blades for broaching of the teeth. The clamp in the foreground feeds the blades as the fixture retracts from cutting position.

Rough pieces are stacked on edge in a horizontal trough with a spring-operated push-feed plate to keep the end piece in the first pick-off station. The work is transferred to the open chuck jaws, held by a pusher plate and clamped by the chuck. During this loading phase, the unloading arm removes the previous piece, raising it to the stripper station at the upper end of the gravity transfer chute. The pieces then flop over by their own weight onto a small curved ramp that leads to the loading station of the second machine, thus presenting the back of the part to the second operation tools. The handling cycle is repeated here and the parts are delivered by gravity to tote pans. All controls are automatic and safety devices prevent faulty performance.

Production totals 420 pieces an hr and the control panel is a dual type on a swinging arm. Each machine has individual stop, start and jog buttons. Machine data include: Spindle speed, 402 rpm; feed, 0.008 in. per revolution; and cutting speed, 338 sfpm.

Examples such as these are typical of how turning and boring machines can be adapted to automatic loading where production consists of small or medium sized parts. While these mechanisms are somewhat elaborate, adaptations and variations could be developed to suit specific purposes. Naturally, there is always the question of cost v. savings, and a common sense approach must be made to the problem so as to reach the optimum compromise between the additional cost involved and the savings that will accrue from the use of such devices.

Milling presents many opportunities for fast work handling. Multiple fixtures, where one is loaded and unloaded while another is in machining position, is one approach to the problem. Likewise, magnetic chucks and multiple chucks speed milling operations. Typical of multiple chucking is a keyway milling job developed by Rockford Magnetic Products Co., Inc., Rockford, Ill. Eight shafts are held magnetically while eight keyway milling cutters on a single arbor cut keyways in shafts. Such workholding tech-

FIG. 11—For headed parts where through-feed on centerless grinders is impossible, this in-feed arrangement can be used. Parts are stored in hoppers, lifted out on the track and fed into grinding position automatically. After the grinding cycle, the parts are disposed of by a gravity chute.

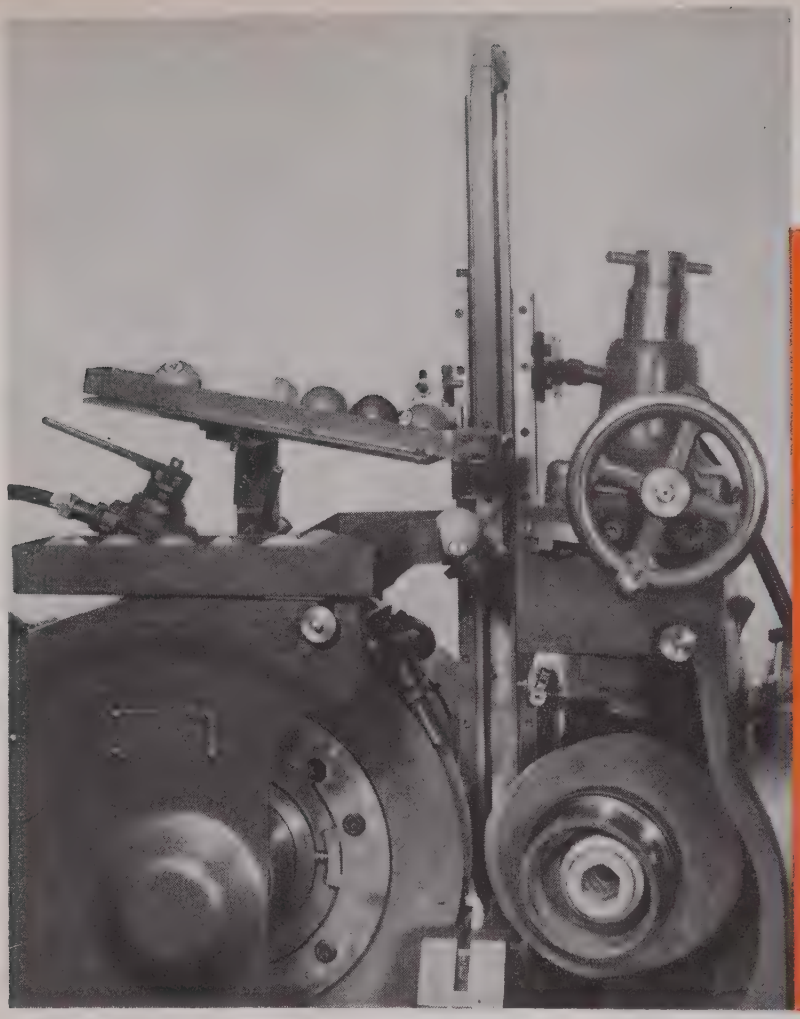

FIG. 12—A novel work positioning arrangement is shown here. Pool balls are loaded from the top rack onto the circular detail. This drops the ball to grinding position, resting over the work blade and out of the path of the wheels. On its up stroke, it tips the ball off onto the lower tray.

niques are adaptable to a great variety of operations.

An automatic feed for handling small round pieces increased output 10 times at Fairchild Camera & Instrument Corp., Jamaica, N. Y.[7] The fixture, with a hopper-type loading device, can be used for any milling operation that involves small parts and a single or double cut. Made to close tolerances, the fixture inspects and rejects oversized parts.

Cincinnati Milling & Grinding Machines, Inc., has developed several interesting loading and unloading devices for its milling machines for special jobs. The plain automatic shown in fig. 8 has a semi-special spindle carrier, and a gravity feed work loading fixture. A preset camming arrangement governs the automatic cycle, and the parts roll under a clamp, which is actuated to hold the part while the milling head descends and mills the slot in the end of the bar. The clamp then releases and the part falls through the fixture to the delivery table beneath the loading table.

Such loading devices are not too elaborate and not too difficult to design. They speed up the operating cycle considerably and tend to reduce part rejection because the functions are automatic and not dependent upon operator skill. This being the case, unskilled or semi-skilled help can be used, thus reducing labor costs.

Broaching often lends itself to automatic work handling, and several excellent examples have been developed by Cincinnati Milling & Grinding Machines, Inc. Brass parts are loaded into the two tube-like chutes. As the tools descend one side of the part is broached and the part is pushed through to fall out the chute on the right side of the machine. Lock barrels, loaded into the circular fixture shown in fig. 9, are indexed under the six broaching tools on the machine. The shape of the cut is completed by six individual cuts and the steel strip bolted to the right side of the broaching head unloads the parts onto the top of the loading fixture from where they fall down a chute into tote boxes. The V slots between the part loading slots in the fixture permit the broaching saws to return to their up position.

Band saw blades, loaded through the broach five at a time as shown in fig. 10, are automatically indexed and clamped by a sliding fixture. As the broach descends, cutting the teeth into the saw blades, the fixture is in a forward position, with two clamps holding the parts firmly. At the bottom of the stroke, the fixture retracts backward, the clamp in the foreground travels 6 in.

to the left and grips the blades. The clamp on the right then releases and the clamp on the left indexes the blades to present a new surface to the tool.

During the time the fixture is back away from cutting position, the broach returns to the up position. Then the fixture advances again to cutting position and the cycle is repeated. Fig. 10 shows the fixture in retracted position, with the feeder clamp in the foreground and the holding clamp directly behind it. The box-like detail in the background is a thickness gage for coil run-out, which automatically stops the machine on any major variation in the thickness of the load through the machine.

Centerless grinding especially lends itself to automatic work handling, both in-feed and through-feed machines. The hoppers use an arm type lift to bring the parts to the chain conveyer that feeds the machine. The parts are lifted onto a chain and pass under a star wheel that kicks off overlapping parts. A motor in the hopper box drives the arms, chain, star wheel and auxiliary driving wheels. Cincinnati Milling & Grinding Machines, Inc., developed this line of through-feed type work handling attachments for its line, but similar devices have been in wide use on grinding machines in both production and job shops.

The part feeding rack shown on the centerless grinder in fig. 11, is for in-feed grinding. The parts are directed into grinding position by standard Feedmaster type B hopper feeds. This is a standard attachment and can be adapted to any headed job for in-feed operation. The parts, after grinding, are carried away by the chute that drops away to the left from the grinding wheel.

A novel feed mechanism is shown on the centerless grinder in fig. 12. Pool balls are loaded in the upper rack and unloaded into the lower pan, as shown. The circular part carrier moves to the top rack, trips the chute open and receives a ball. It then descends to grinding position, with the carrier dropping over the work blade and out of the path of the grinding wheel. When grinding is completed, the loader then moves up, lifting the ball to the discharge platform. Here it tips toward the table, unloads the ball, and moves up to the loading rack for a repeat of the cycle. The loading mechanism is hydraulically actuated and linked to the wheel feed attachment by limit switches. The grinding wheel is form ground and the driving wheel is ground in such a manner so as to impart a twisting as well as rotating action to the ball. This assures perfect spherical shape.

Pistons are unloaded off overhead conveyers, placed on a roller track, pass between the grinders and down the roller track. At that point, they are caught by the belt and carried back to a position close to the loading station. Here they are unloaded off the belt onto overhead conveyers again and continue to the next operation. This is a simple but effective method of part handling through the machine cycle.

The work-loading cradle shown in fig. 13 is used for grinding on centers on a plain hydraulic grinder. Dogs are placed on the parts and they are laid in the notch to the rear of the cradle that straddles the hand screw. When the machine cycle is completed the centers retract. The operator unloads the part by hand, lays a new part in the front groove of the cradle and pushes the automatic cycle control button. The centers in-feed and retraction are automatic; and the centers pickup and drop the part automatically. While the part is loaded and unloaded by hand, this is done quickly and accurately.

The work handling devices shown and described are typical of thousands used all over the country. They all tend toward one end—the reduction of total cycle time by means of reducing the non-machining of work handling time. To this end, the machine tool builders and users are working diligently. Work handling techniques and mechanisms offer a great potential for cost savings. Yet, care must be exercised that these mechanisms are adopted judiciously. The cost of such mechanisms, their upkeep and maintenance may, if not chosen carefully, far outweigh the benefits derived from their use. As in practically any shop practices, the use of improved work handling devices is a compromise between what they will cost and what they will save.

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[3] "Packard Transfer Line Machines 50 Blocks an Hour," THE IRON AGE, May 20, 1948, p. 73.

[4] "Transfer Line Drills Ford Crankshafts," THE IRON AGE, June 17, 1948, p. 72.

[5] "Boring and Drilling Machine," THE IRON AGE, Aug. 5, 1948, p. 95.

[6] "Railroad Axle Lathe," THE IRON AGE, Sept. 30, 1948, p. 67.

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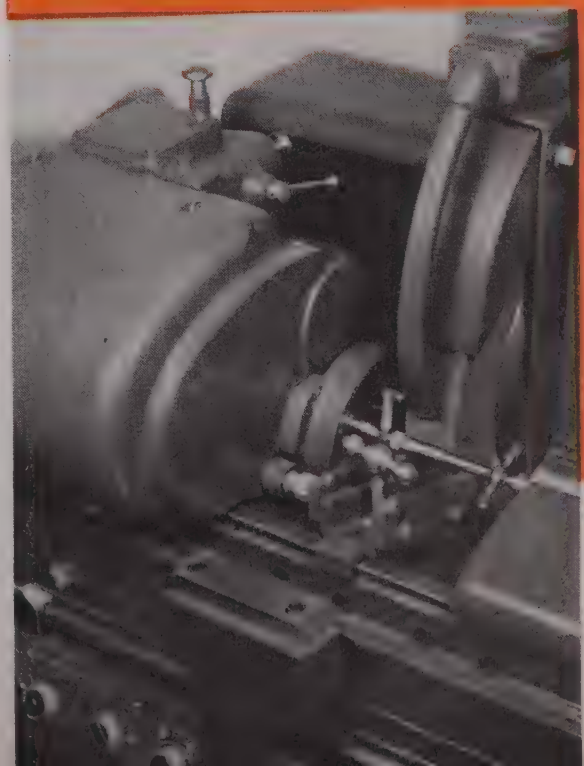
FIG. 13—For grinding on centers, a cradle such as shown here is frequently used for loading. The parts are placed in V-grooves at the rear of the cradle and the centers pick them up. Wheel in-feed and return and movement of the centers are automatically controlled.



metallurgy

Despite continuing equipment restrictions and material shortages, many noteworthy achievements were added to metallurgy's record in 1948. More practical approaches to oxygen use, hot topping innovations to improve yield, cold extrusion of steel, continuous casting, high temperature ceramics and ceramals are but a few of the highlights recorded in this report. Nor are the glamour girls — titanium and radioisotopes — overlooked.

By E. S. KOPECKI
Metallurgical Editor,
THE IRON AGE

Considering the pressure exerted upon the metalworking industry for more and yet more production, it is gratifying to observe the many improvements and new developments that materialized during the past year. Much of the progress reported was reflected in increased production rates and, to some extent, reduced operating costs. But a great deal of attention was directed toward quality considerations, new materials and new processing techniques.

The year 1948 saw no appreciable easing of the steel shortage, in spite of the hopes expressed by some optimists a year or so ago that the use of oxygen would solve the steelmakers' production problems. Even the oxygen producers' estimates concerning the influence of oxygen on steel production are definitely conservative. As one engineer close to the overall situation recently remarked, "If oxygen has been responsible for additional steel tonnage, it would certainly be impossible to prove it on the basis of percentage increase."

A newly appreciated metal, titanium, has appeared on the stage, and a technique for extruding cold steel commercially is on the threshold of success. Ceramics and ceramals hold promise of becoming the high temperature metals of the near future. Neither can one overlook the commercial fulfillment of a dream of many years—the continuous casting of steel.

The use of oxygen has grown considerably during the past 3 years, to the extent that today it is employed in the openhearth, the electric furnace, the cupola, the bessemer converter, the sideblown converter, and the blast furnace.

The blast furnace application is particularly new. A low-purity oxygen plant, constructed at Bethlehem Steel Co. for experimentation in connection with its Johnstown Works blast furnace operations, has been put into operation within the past 3 months. Experiments conducted to date are of a preliminary nature and no conclusive data have yet been gathered.

In the basic electric furnace, oxygen can be used (1) to remove carbon during the refining period, (2) to control bath temperature, and (3) as an

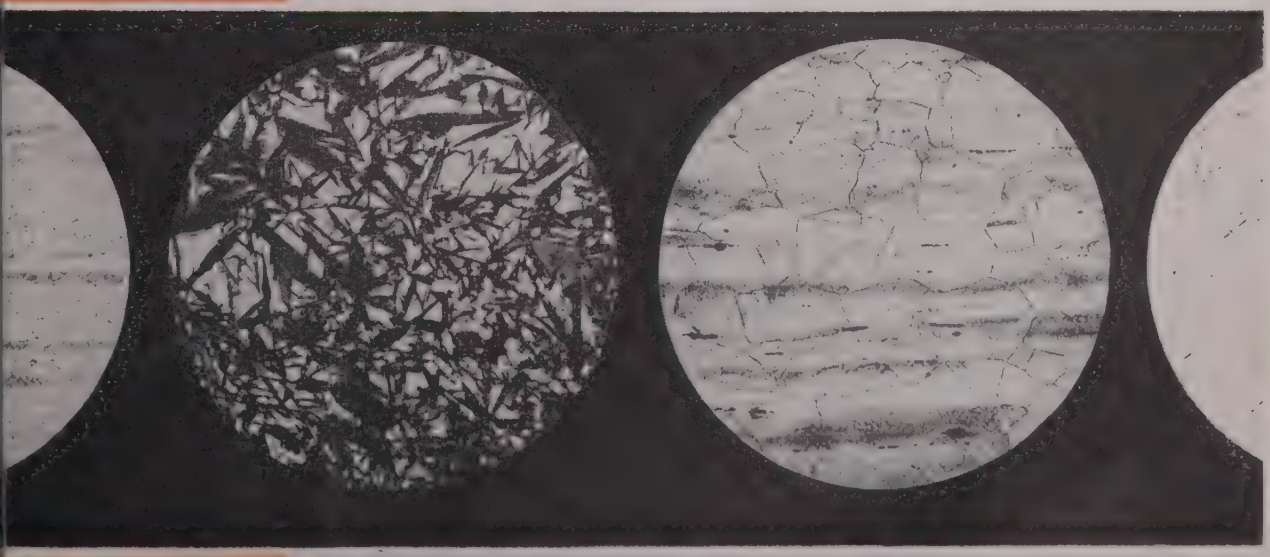


FIG. 1—Teeming a heat of steel at the Watervliet plant of Allegheny Ludlum Steel Corp., using the Kellogg electric hot top. The molds at the right of the ladle have already been filled and the hot top units are in action, while to the left of the ladle can be seen the empty molds alongside of which are visible hot top units ready for use.

aid in scrap meltdown. Oxygen can also be used to advantage when a rapid increase in bath temperature is desired or to speed up melting. In fact, an operator reported recently that oxygen was used in his shop to finish a heat for tapping on an occasion when a power failure was encountered.

Foundry electric furnace (acid) operators have also adopted the use of oxygen, and have realized the advantages of (1) increased bath temperature, even though the power is off throughout the injection, (2) higher metal fluidity than when using ore, (3) increased recovery of oxidizable alloying elements, and (4) decreased operating costs.

Generally speaking, oxygen is used essentially in making low carbon steels, such as stainless, electrical, etc. (and to a great extent rimmed steels in the electric furnace). The number of plants using oxygen in making steels finishing in carbon above about 0.30 C is rather limited. Most of the stainless steel producers have incorporated oxygen into their melting practices and have realized increases in steel quality at reduced power costs. Of importance also is the increase in chromium recovery, which with the use of oxygen has been raised to about 85 pct.

Foundries are becoming more interested in oxygen in cupolas and are using oxygen at start and finish to maintain temperature and also to synchronize pouring operations. This limited application has been recommended, because in spite of the increase in melting rate and in furnace temperatures, it has been found that the excessive temperatures resulting from continued use of oxygen are beyond the useful range of normal cupola refractories.

Another interesting application only recently publicized is the use of oxygen-enriched blast in the side-blown converter. Based on extensive production operations in England, it was found that higher steel temperatures and shorter blowing cycles were possible, accompanied by a reduction in blowing loss, easier control of the end point, and the ability to use a higher scrap charge.

Work was also conducted in this country in connection with the bessemer converter, the results generally confirming the German studies that were conducted several years ago.

From the standpoint of the openhearth, most attention has been directed toward the use of oxygen for decarburization, where quantities consumed are considerably smaller than when oxygen is used as an aid to combustion. About the only significant data relating to the latter application were revealed by J. Marsh, at the 1948 AISI meeting, where he described experiments conducted by Bethlehem Steel Co. In lancing operations for decarburizing, interference is experienced, because the oxygen is normally introduced through the charging doors. A mechanized setup at a large steel company, where oxygen is inserted through the back wall, is said to be promising.

Investigations with compressed air have not worked out too well due primarily to refractory troubles caused by excessive splashing.

Many openhearth operators have found their oxygen experiments to be hampered because of the civic nuisance caused by the dense red smoke and fume emitted from the stack during oxygen operations. This problem has been overcome somewhat by the use of a venturi scrubber which has been found to be more than 99 pct efficient in iron oxide fume removal. The success of this unit in connection with an openhearth furnace operation has aroused the interest of some electric arc furnace and blast furnace operators.

Efforts to increase ingot yield have received considerable attention from steelmen, due essentially to the existing steel shortage and to the rising costs of producing steel. Many methods are being tried to overcome the formation

of pipe in ingots, with much emphasis being placed on keeping the metal at the top of the ingot (or in the hot top) molten until the remaining metal has solidified.

One such method, developed by the M. W. Kellogg Co., employs a water-cooled, nonconsumable electrode and a special slag possessing certain characteristics so that heat, in the form of an electric discharge, is liberated to the top metal in the ingot. The ingot metal is protected from the atmosphere and the apparatus is designed so that no contamination of the metal takes place.

This process has been in experimental use for several years, and in actual production for about a year (see fig. 1), in the production of stainless steels, tool steels and high temperature alloys primarily. One steelmaker recently reported that utilization of this method made it possible to increase his average yield of high-speed steel to 90.7 pct, which represented an increase of 7 pct over conventional practice.

A large steelmaking company has developed a somewhat similar technique, whereby a consumable graphite electrode, associated with 25 cycle, three-phase ac current, is employed. Stainless steels, tool steels and high temperature alloys have been made in molds ranging in size from 13 in. square to 26 in. corrugated, with an increase in yield to about 81 pct. The maximum weight of metal treated, per phase, is 6800 lb. No carbon pickup is experienced, due to the use of special slags, which are made from commonly-occurring flux materials (and alloys as required).

Another technique, which has been investigated experimentally by a roll foundry, is the use of a gas-heated hot top. Alloy steel rolls, ranging in weight from 12 to 32 tons, have been made with this method, and it has been found that when gas-heating is employed, only about half the weight of hot top metal is required, as compared with conventional practice.

Induction heating of hot tops has also been under study for some time, but cost factors evidently are not sufficiently attractive to warrant its commercial application at this time.

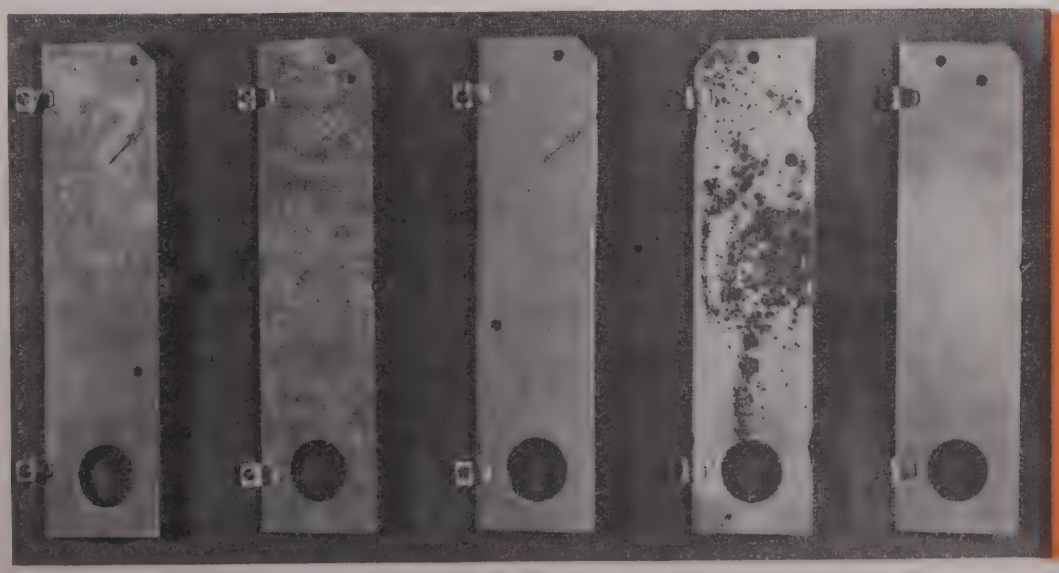
Manufacture of sponge iron by direct reduction from iron ore received sporadic attention this past year, but no new data were brought forth to indicate any noteworthy expansion in the world's production of this product.

The situation was reviewed by Earle C. Smith at the 1948 AISI general meeting, with an analytical resume of various types of direct reduction techniques. Smith's opinion of the prospects for sponge iron as competing with the coke blast furnace was summed up in his comment that "the largest direct reduction plants which now operate, the only plants worth discussing, are still relatively small units. They could not provide iron enough to operate a single small basic openhearth."

Notwithstanding Smith's comments concerning the production of sponge iron on a large scale, the current scrap situation in Canada was considered sufficiently serious to warrant a survey of the possibilities of producing some sponge iron in Canada, from Canadian ores, at a price competitive with imported scrap.

The investigation, which was conducted by the Ontario Research Foundation, resulted in a shipment of Canadian Steep Rock ore to Soderfors, Sweden, for experimentation in the Wiberg furnace. The ore was found to be an ideal feed for the Wiberg furnace and gave higher production rates than most other ores that have been tried. Cost data calculated on the basis of the tests indicate the economic feasibility of installing the Wiberg process in Canada and producing sponge iron at costs competitive with the current price of imported scrap.

Experimental work is also underway in the production of feed ore for the blast furnace and openhearth. The Mines Experimental Station at the University of Minnesota is attempting to develop a pelletizing process for agglomerating finely ground iron ore. Ore, corresponding approximately to the particle size of concentrate produced from Minnesota taconite, through 100 mesh with at least 60 pct −325 mesh, seems to be suitable for the process. Balls of concentrate are fed into the top of a vertical shaft furnace, are subjected to a temperature of about 1830°F and agglomerated into solid spheres. These are discharged from the



52S-½H Aluminum — *Alclad 75ST Aluminum* — *Type 316 Stainless Steel* — *Monel* — *Commercially Pure Titanium*

FIG. 2—The superiority of titanium with respect to salt water corrosion, compared with various other materials, is indicated by the samples shown in this photograph. The tests were made over a period of 4 months' continuous immersion in sea water at Kure Beach, N. C.

ABOVE

FIG. 4—Continuous casting of a 9-in. diam ingot of high temperature alloy 16-25-6 by the Kellogg method, from which will be manufactured a J-33 turbine wheel. Photo shows the consumable electrode extending into the top of the ingot mold.

ABOVE, RIGHT

FIG. 3—The extruded part shown at the right illustrates the possibilities attainable in the cold extrusion of steel. The part was extruded from the billet (shown at the left) in one step and represents a reduction of 85 pct in cross-section area. Note that only the upper half of the billet was extruded; use of a double acting press would make possible the extrusion of a different size section in the lower half of the billet.

bottom of the furnace and are ready for shipment to the blast furnace.

Another investigation on this subject, which is being undertaken at Hanna Furnace Corp., is a continuous fusion operation and uses ores of any degree of fineness as the raw material. The iron content of the product, resulting from materials normally carrying 50 to 55 pct iron, can be increased to more than 75 pct. To date more than 1000 tons of flue dust and other iron-bearing materials have been successfully processed—the fineness of the raw material seems to make no difference except that each different material requires a different preheating temperature and different blast pressure.

Carbon for Blast Furnace Operations

The general acceptance of carbon as a blast furnace construction material allows observation and comparisons to be made on furnaces that have been in operation long enough to disclose significant facts. The first carbon-lined blast furnace has been operating about 4 years with every indication that its performance has been highly satisfactory and that the campaign will extend far beyond earlier expectations. To the 31 carbon block-lined blast furnaces reported in January, 1948, one manufacturer reports that 22 double-course carbon block linings have been added, to make a total of 53 in the U. S. Not a single failure of a double-course lining has been reported to date.

One steel company reported on a carbon block-lined furnace, with a hearth diameter of 19 ft, that was blown-in on Mar. 14, 1946. With a daily capacity of 700 tons, the furnace had produced 599,000 tons of metal up to Nov. 1, 1948. Another carbon block-lined furnace of the same company, having a hearth diameter of 27 ft and a daily capacity of 1200 to 1400 tons, had produced 622,000 tons up to Nov. 1, 1948. Both of these furnaces have been down to some extent since blowing in because of shut-downs due to labor.

Based on its experience with both types, the company reports the following comparisons between carbon linings and refractory linings: (1) carbon-lined furnaces produce more uniform casts, and (2) carbon-lined furnaces never have had an initial cinder cast, and consequently cast cleaner metal.

The prominence that has been given to carbon blast furnace linings for some time now should not be allowed, however, to overshadow the importance of the other uses of carbon in the furnace, such as carbon-lined tapping holes, iron troughs and runner linings. By avoiding the use of sand in the runner a cleaner iron will be delivered to the melting shop. This applies to slag runners as well as iron runners. Since most of the sand used in runners finds its way into the slag and metal ladles there is considerable advantage to be gained by dispensing with the sand.

To correct the timeconsuming and costly operation of removing ceramic brick work from the cinder notch opening, after the furnace has been banked, many mills now substitute standard 9 in. straight carbon brick for ceramic brick. The carbon brick will not become firmly bonded to the ceramic brick and are easily renewed when required. Also, slag will not fuse with the carbon and the entire operation of removing carbon brick may require only a couple of hours, in contrast to 40 to 50 hr when ceramic brick is used.

Several mills now are using one-piece carbon skimmers. Records of six different carbon skimmers from one furnace show an average use-life of 35 days. The furnace cast five times per day, each cast being about 140 tons.

When standard 9 in. carbon brick, in either straight or arch shapes, are used in splash plate construction, as many as 345 casts (69 days) have been obtained. A probable conservative average is 150 casts, or 30 days, before the carbon brick needs replacement.

A recent successful innovation in splash plate design involves the use of a one-piece 30x48x7¼ in. carbon slab suspended in a welded steel frame. The life of this plate runs an average of 75 casts, at about 200 tons per

cast. On another furnace, of smaller size, the average life is 125 casts of 125 tons per cast. Only a few minutes are required to slide out an old plate and replace it, as compared to the considerably longer time required to fit and cement about 75 individual bricks per plate.

Extensive investigations are under way toward developing the use of carbon shapes as a stack lining and one furnace stack has been partially lined. The lining extends upward for 7 ft from the bottom of the tuyere plates and has been in service since March 1948. The successful use of carbon as a lining for stacks would be its most significant contribution to the industry since carbon was introduced for hearth lining.

Industrial World Eyes Titanium

A subject that has quite overwhelmingly aroused the curiosity of industry in this country and in Canada, and which has definitely captured the imagination of the popular press, is titanium. An article published within the past two months in a popular weekly magazine, for example, visioned "the prospect of titanium destroyers and submarines, titanium fighters and bombers, titanium transocean passenger planes, titanium railroad trains" and referred to titanium as the "Cinderella of metals." Contained in this article, however, amidst a great maze of flowery language and unrestrained enthusiasm was this short, simple, yet all-enlightening sentence: "As yet, there has been no industrial use of metallic titanium."

Extensive research during the past few years has established that titanium is a light, strong, corrosion-resistant metal possessing attractive physical properties and promising alloying possibilities. Accumulated data are admittedly meager and regarded by those in the field as preliminary.

Among the companies that have exhibited a strong interest in metallic titanium is the Remington Arms Co., Inc. This firm is concentrating on the development of alloys and techniques for fabrication and has been conducting its investigations with a commercially pure titanium of 99.5 pct purity.

Some typical physical room temperatures of annealed titanium sheet are as follows (values in parenthesis indicate properties of 50 pct cold-worked sheet): 80,000 (125,000) psi tensile strength; 72,000 (110,000) psi yield strength, 0.2 pct offset; 25 (12) pct elongation; 55 (30) pct reduction in area; and 60 (64) Ra hardness. The strength of titanium does not decrease excessively at temperatures up to 800°F, but at about 1300°F, oxygen and nitrogen are absorbed from the atmosphere over extended periods of time, and the metal loses its ductility.

Sea water and marine atmospheric corrosion resistance of titanium (see fig. 2) have been found to be superior to austenitic stainless steel, Monel and the cupronickel alloys, and as good as the two best known materials, platinum and Hastelloy C.

It is recognized that the potential of titanium lies not in the metal itself, but in its alloys, and hence much investigation is underway in this direction. Progress will necessarily be slow because of the very nature of an alloying program, plus the fact the techniques must be found to melt and work and fabricate the alloys, while avoiding contamination with oxygen, nitrogen and hydrogen. Economy will also play an important role in this program, because unless components and structures can be produced at much less cost than is now possible, the applications of titanium will indeed be limited.

Another phase, that of production of metallic titanium from its ore, is also being investigated thoroughly, since processing will necessarily influence both cost of the metal and its availability in quantity. Researchers are seeking ways to modify existing processing methods as well as to establish new procedures that might offer more promise from the standpoint of economical, large-scale production. A Canadian company, Dominion Magnesium, Ltd., for example, has announced a processing method whereby titanium is said to be reduced directly from the oxide. It is claimed that the metal can be produced in this manner at less cost than existing methods and at substantially the same purity.

Cold Extrusion of Steel

Continuing the investigations that were originated in Germany and elsewhere in Europe during the war, on extrusion of steel, the Heintz Manufacturing Co., Philadelphia, has, in the past 2½ years, developed methods—embracing both tool design and lubrication phases—which demonstrate quite forcibly that steel is a plastic material at room temperature.

Finished parts, particularly tubular and cylindrical components, may be made from cold steel, utilizing presses, at room temperature. Significant savings in cost as well as steel, are realized, compared with conventional methods of forging and/or machining. The Germans extruded only the low carbon steels, primarily 1010 steel, which had to be selected on the basis of cleanliness, and carried out the extrusion to only about 70 pct reduction in cross-section area. Heintz, on the other hand, has extruded various types of low and medium carbon steels as well as low alloy grades, and has successfully obtained reductions up to 85 pct in one step. See fig. 3 for a typical example of such an extrusion.

Cold extrusion of steel has been made possible commercially by use of a crystalline metal phosphate coating, which acts as a host for a lubricant and which provides a lubricant film so durable that when the steel is subjected to compressive force suitable to make it flow through an extrusion die, the lubricant film is maintained unbroken between work and tools, preventing galling.

The data obtained to date have been concerned principally with the manufacture of ammunition components and other military items.

A good example of metal saving is illustrated by the production of the standard 75 mm shell. A round-cornered square steel billet, weighing 22 lb, is hot forged, machined, subjected to 29 operations, and the finished shell weighs 10¾ lb—or less than half of the starting billet. Application of the cold extrusion method to the

manufacture of this item permits starting with a billet weighing but 11.3 lb, and results in a net metal saving of 550 tons of steel per 100,000 shells. Also, experimental work done on the extrusion of the 105 mm howitzer cartridge case from a sheared billet indicates a yield, from the ingot, of at least 250 pct of that obtained by drawing certain types of cases from disks by conventional methods.

The drastic cold working caused by the extrusion technique seems to increase significantly the yield strength and tensile strength properties. This factor has brought about further savings in metal due to the fact that various parts can be made in thinner sections than now feasible. This applies particularly to ammunition components but will probably apply as well to many industrial parts.

Ceramals Highlight High Temperature Studies

In spite of the noticeable decrease in published data relative to high temperature metallic alloys during the past year, research and development work embracing ceramics and ceramic-metal combinations is continuing on an extensive scale.

Uncooled metallic alloys are said to be limited to about 1500°F with any degree of life expectancy, with temperatures of 1700° to 1800°F anticipated for the high molybdenum, chromium or tungsten alloys. To reach temperatures of 2000° to 2500°F, at which thermal efficiency of the gas turbine is elevated considerably, ceramics or ceramal materials appear to be necessary.

The Air Materiel Command program, incorporating the efforts of various institutions, includes projects concerning the development of coatings for metals, development of high-temperature ceramic or composite bodies for the many diverse forms of application, development of furnaces for firing high-temperature materials, development of means for accurately measuring high temperatures, and establishment of procedures so that comparable and consistent results may be obtained.

Within the past month data were revealed indicating the results of investigations conducted at the NACA Cleveland laboratory using ceramic and ceramal materials as turbine blade components for aircraft gas turbines. A number of ceramals, containing titanium carbide as the ceramic and cobalt as the metal in varying proportions, were evaluated in elevated temperature tensile tests. At a temperature of 1800°F, the best ceramal was found to be competitive in tensile strength with the best commercial heat-resistant alloy and with the best National Bureau of Standards ceramic, although inferior to the best hot-pressed ceramic. At 2200°F, the best ceramal was found to be superior to the best commercial heat-resistant alloy and competitive with the best hot-pressed ceramic.

Carbide-base materials possessed good thermal shock resistance and operated cooler than most high temperature alloys or oxide-base materials, although they could present oxidation problems and difficulties with wheel cooling. The NACA report also indicated that both ceramics and ceramals have operated as blades in gas turbines at temperatures above those in service use with alloy blades, although speeds were lower.

In another approach to the ceramal problem, blades have been made by combination of powder metallurgy and precision casting methods, based on tungsten, tungsten carbide and tungsten-titanium carbide as major phases and oxidation-proof nickel base alloys as binders (or cementing metals). By proper heat treatment, a structure can be obtained possessing much greater oxidation resistance than normally experienced with these components, and hot strength values (hot transverse rupture) are said to be above those of cemented carbides.

Ceramic coatings are also receiving attention. In addition to porcelain enamel, several other coatings are being considered for certain specific applications, including brushed or sprayed-on ceramic paints, which require no firing prior to use, the highly refractory oxide or metal-bonded coatings, and the extremely thin or surface treatment type coatings. One type coating developed as a protection for molybdenum consists of a base coat of a low-expansion frit with 20 pct zirconia added, a cover coat containing 95 pct zirconia, and a seal coat consisting of a thin application of the same composition as the base coat. Its application for uses at extremely high temperatures, say about 3000°F, where prolonged service is not required, is promising.

Continuous Casting of Steel Industrial Reality

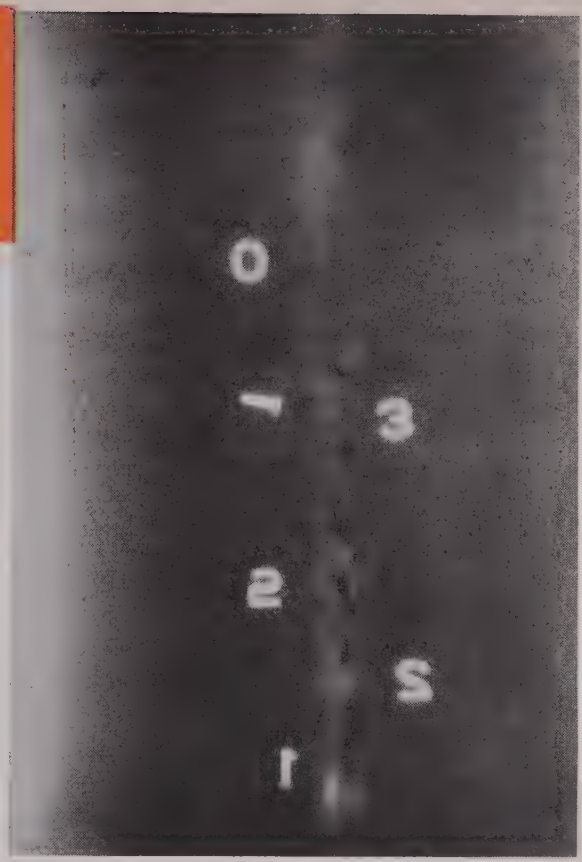
The past year also saw the commercial fulfillment of a long-time dream—the continuous casting of steel. Credit for this commercial success goes to Republic Steel Corp. and Babcock & Wilcox Tube Co., who, operating in partnership, made possible the shipment on Mar. 18, 1948, of the first carload of rolled bars made from continuously cast steel billets for conversion into commercial products. This accomplishment was described in detail in THE IRON AGE, Aug. 19, 1948.

Although the continuous casting of nonferrous metals has been routine industrial practice for the past 10 years, the adaption of this method to steel has been a major undertaking. Higher metal temperature, erosion, segregation, slag inclusion and safety factors are a few of the problems present in steel.

Another continuous casting technique announced this past year is the electric ingot process developed by the M. W. Kellogg Co. Especially adaptable to the production of steels requiring extra high quality or some special properties, the method has been utilized particularly for making tool steels, stainless steels, and the complex high temperature alloys.

Differing completely from the Babcock & Wilcox technique, the Kellogg process employs the use of strip, supplied in coils, to introduce one of the basic raw materials. The strip is passed through a tube-forming machine, where it is formed into a cylindrical electrode with edges butted, and then is passed through a contact shoe, where it picks up the current used for

FIG. 5—A radiograph made with Se75 as the radiation source. Type A film was used, and the exposure was 2 hr. The weld was made intentionally poor in order to test use of Se. The dark areas show slag pockets. The numbers have no significance.



melting. After passing the contact shoe, it extends into the mold, see fig. 4, where the current discharge takes place below the slag blanket. The location of the current discharge below the bottom of the contact shoe is maintained at substantially a constant distance throughout the melting process. When one coil is nearly consumed, it is welded to a new coil while melting is in progress.

The continuous casting of copper alloy products, although not new, came in for its share of attention with the description, for the first time, of the Asarco process as employed by American Smelting & Refining Co. Commercial usage has confirmed the superiority in quality from improvements in fineness, degree and uniformity of the dispersion of secondary constituents, and the freedom from segregation that the process affords. Also, the unusual soundness, malleability and ductility of continuously cast stock has resulted in substantial increases in the ratio of finished weight to cast weight in leaded bronzes.

Heat Treaters Augment Automatic Operations

Among the interesting developments in heat treating has been the adoption of two concepts, cyclic annealing and cyanide hardening, which have been recognized for some time but which, for various reasons, have not been generally accepted.

Cyclic annealing, which makes possible reductions in annealing times of up to 50 pct, can be accomplished in open-fired furnaces, controlled atmosphere furnaces and salt bath furnaces. One recent published report indicated the simultaneous cycle annealing of up to eight different grades of low to medium carbon alloy steels, producing in each steel a good machinable structure.

The salt bath furnace is particularly adaptable to this process, especially in the case of forgings, in that it can be injected into the cycle. The Ajax Electric Co., in cooperation with several automobile manufacturers and forging plants, has developed a technique whereby the residual heat in forgings coming from the press or hammer could be utilized for annealing the forgings.

The forgings, which come from the press at a temperature of 1700° to 1800°F, are immediately quenched into the salt bath, operating at a subcritical temperature (1150° to 1300°F), and held until transformation is completed. A water quench then removes all scale and eliminates the need for shot blasting and pickling. In some installations the salt baths are equipped with mechanisms so that all operations are performed automatically and in timed sequence.

Cyanide hardening, also referred to as dry cyaniding and carbo-nitriding, has received renewed attention. In salt baths, steel parts absorb both carbon and nitrogen from the molten salt to produce file-hard cases up to 0.010 in. max. The internally-heated electrode type salt bath furnace has played an active role because of its accurate control of bath temperature together with its rapid heating rate. Depth and hardness of case are said to be uniform regardless of the shape of the work and distortion is kept to a minimum. Batch type furnaces are most generally used for cyanide hardening, but the mass production industries are installing more and more fully mechanized furnaces.

Utilization of this process in gas carburizing furnaces, employing a mixture of carbon-bearing and nitrogen-bearing atmospheres, makes possible conducting the operation at about 1500°F rather than at conventional gas carburizing temperatures of 1675° to 1700°F. This then makes possible use of a slower quenching bath and reduces susceptibility to distortion.

A process, termed homogeneous carburization, has recently been introduced. Significance of the method lies in the fact that it is possible to start with low carbon steel strip or sheet stock, form it into shapes and then make the material possess the desired springlike or strength qualities by diffusing carbon throughout the thickness, followed by suitable heat treatment. The material may be up to 0.10 in. in thickness and still be effectively treated within economical time limits.

Salt bath rectification is claimed to have been

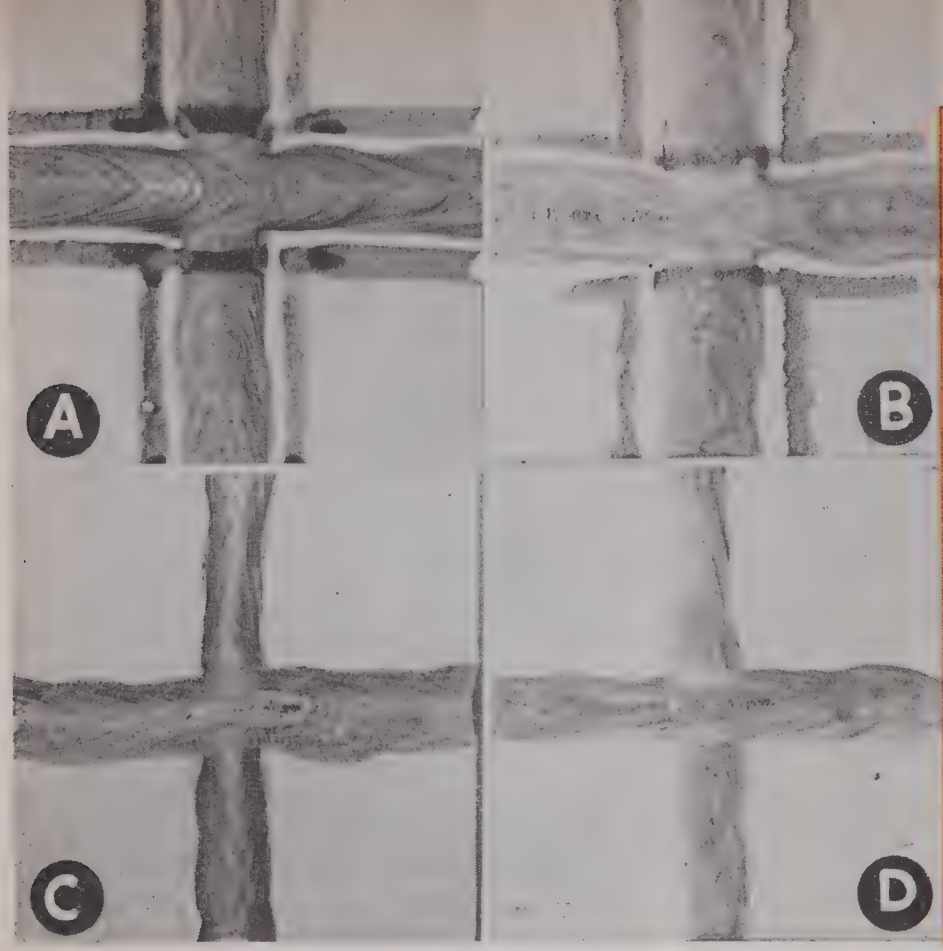


FIG. 6 — Appearance of metal-arc welded (A) type 304 (0.06 C) sheet and (B) type 316 (0.07 C) sheet and their low carbon (0.03 pct) counterparts, (C) and (D) respectively, after three 4-hr periods in 10 pct nitric 3 pct hydrofluoric acid solution at 175°F. Note intergranular corrosion on base metal heat-affected zones in (A) and (B) and lack of localized attack in (C) and (D). As-welded condition; 1.5X.

improved through the use of a carbon type rectifier block which supplies active carbon monoxide and free silicon for purging the decomposition products. Applicable particularly to high speed baths, the rectifier is used during the idling period of the furnace.

Radioisotope Application Investigations Continue

The past year has seen quite a variety of metallurgical and chemical investigations undertaken, employing radioisotopes as tracer elements. Although the program is lagging somewhat behind expectations, it is reasonable to assume that expansion will be more rapid after sufficient data are accumulated so that more or less standard procedures can be set up.

A study was recently conducted, using radioactive tracers to determine the principal sources of sulfur in coke. Sulfur exists in coal as pyritic, organic and sulfate sulfur, and since the sulfate sulfur content of most coals is very small, the experiment was designed to indicate how much pyritic and, by difference, how much organic and sulfate sulfur remained in the coke after carbonization. It was hoped that the results would serve as a guide in the selective purchasing of coal to produce a low sulfur coke.

The technique employed involved the preparation from radioactive sulfur of a small amount of iron pyrites which was then mixed thoroughly with the coal charge to one full-scale coke oven and the mixture coked under normal conditions. The course of the pyritic sulfur was then traced in order to determine the quantity evolved in the gas and the quantity remaining in the coke.

Other investigations have been initiated concerning diffusion characteristics, embracing annealing, hardening, recrystallization, grain growth, creep, high temperature behavior and carburizing; also being studied are self-diffusion mechanisms for various metals. In one case, radioactive carbon is employed to determine the influence of carbonaceous compounds on grain size characteristics of metallic magnesium.

Of interest to the steel industry is a program whereby radioactive lining materials are employed in order to determine, quantitatively, the influence of ladle refractories on inclusion content in steel. Studies concerning plating phenomena, corrosion, friction and passivity in chromium-iron alloys are also being conducted. The tracer technique is said to be particularly suited to the study of flotation problems because of its sensitivity and its ability to label individual additions of agents. This latter characteristic makes it possible to deal with problems in which self-diffusion or self-replacement are thought to occur.

Although the radioactive tracer method does show promise of becoming an important tool in the hands of the researcher, it is by no means a panacea for investigation problems. There are several shortcomings that must be overcome before the potential of the technique can be realized.

Impurity of isotope materials, for example,

causes trouble in conducting various analytical studies. Even though impurities are present in minute quantities, side reactions can occur that concentrate the impurity. As a specific instance, calcium contains small amounts of phosphorus, but the phosphorus reaction is so prominent, when associated with iron or steel, that it overshadows the calcium reaction. True, the calcium and phosphorus characteristics can be separated, but at the expense of much effort and lost time. Results obtained with the use of radioactive iron are claimed to be questionable due to the presence of unknown impurities.

Another problem confronting investigators is the fact that the radioisotope measuring apparatus is still not sufficiently developed to give precision in reproducibility of results. Also, Geiger tubes respond differently to different types of radiation, so that it is almost impossible to obtain accurate disintegration determinations.

With the thought that some of the difficulties in making quantitative determinations of radioisotopes can be eliminated if standard sources of the radioisotope under measurement are available, the National Bureau of Standards has announced a program whereby such standards will be issued to industry.

Autoradiographic work has been attempted but has not proven very promising. Resolution is poor and difficulty is encountered in applying proper emulsions to different types of radiation. Also, it is extremely difficult to then match up the print that may result, with the microstructure.

Some interesting radiographic studies have been made at the Ford Motor Co., using Se75 as the radiation source. Fig. 5, for example, shows a radiation of a weld made intentionally poor in order to test the use of a radioisotope as source. On an overall basis, radioisotopes have been found to have no advantage over radium, but in thin steel, say ½ in. and under, the radioisotope gave greater sensitivity.

Measuring the height of liquid iron in a cupola is another possible application for radioisotopes. The radioisotope, possibly Se75 or Co60, is located on one side of the hearth, and a detector is placed on the other side. This technique is said to be sufficiently sensitive to be of practical value. A pilot installation of this type is planned for this year.

The hardenability situation has shown little change during the past year except that the number of steels being ordered on a hardenability basis has been substantially increased. This brings to about 80 the number of steels which are now available as H-band steels. Also, about half of the existing SAE hardenability bands have been narrowed on the basis of accumulated experience, and changes of from ½ to 2 points have been made (for certain steels) in the distance range from 1/16 to ⅞ in. along the Jominy bar.

Some experimental work is being done to determine the extent to which certain chemical changes can be made that will not adversely affect the tensile properties, machinability or carburizing characteristics. The thought is to decrease the carbon range and simultaneously increase the manganese and chromium ranges. There is merit to such a proposal inasmuch as one user has for some time ordered shallow-hardening steels to specified analysis, carbon for hardness and alloys for hardenability.

Two objections that might be raised, however, are (1) increase in cost due to the alloy content, and (2) lack of manganese. The ferroalloy people advise that manganese supplies are getting more and more critical and that a definite shortage will soon have to be faced.

It is interesting to observe that, in spite of the unfavorable reaction of the SAE hardenability committee towards the PV test for shallow-hardening steels, use of the method has extended to some 15 plants in the United States, Canada, Norway and Sweden. Further expansion seems inevitable, inasmuch as some large steelmakers are included in the list of 15, and continued use on their part will result in some, if not all, of their customers also resorting to the PV test.

Intergranular Corrosion of Stainless Steel

Recognizing the desirability of avoiding intergranular carbide precipitation by producing austenitic chromium-nickel steels of very low carbon content rather than by the addition of a stabilizing element, such as titanium or columbium, steelmaker and consumer alike have been conducting extensive investigations in order to understand, quantitatively, carbon and alloy relationships and resulting influences on intergranular attack, corrosion resistance and physical properties. Studies have been reported in the past year concerning chromium nickel stainless steels containing carbon ranging from 0.005 to 0.13 pct.

Most investigators seem to agree that reduction in carbon content to about 0.015 to 0.020 pct will impart complete immunity; unfortunately melting techniques have not been yet developed to make this commercially practicable. Application of oxygen to steelmaking practice has contributed significantly to the ability to make lower carbon stainless steels; in fact, several steel companies are now in the market with steels containing 0.03 pct C.

It has been observed that 0.03 pct max C content imparts adequate immunity to harmful intergranular carbide precipitation which may occur in certain fabricating operations. This enhanced resistance also permits welding many types of equipment in the field without hazard of subsequent failure through intergranular corrosion. An example of this is shown in fig. 6[1] where metal-arc welded sheets of type 304 (0.06 pct C) and type 316 (0.07 pct C) are compared with their low carbon (0.03 pct) counterparts.

[1] *Discussion prepared by M. E. Carruthers, supervising metallurgist, and G. E. Linnert, senior research engineer, Armco Steel Corp., Middletown, Ohio and Baltimore, respectively, and presented at the 30th annual convention of the ASM.*

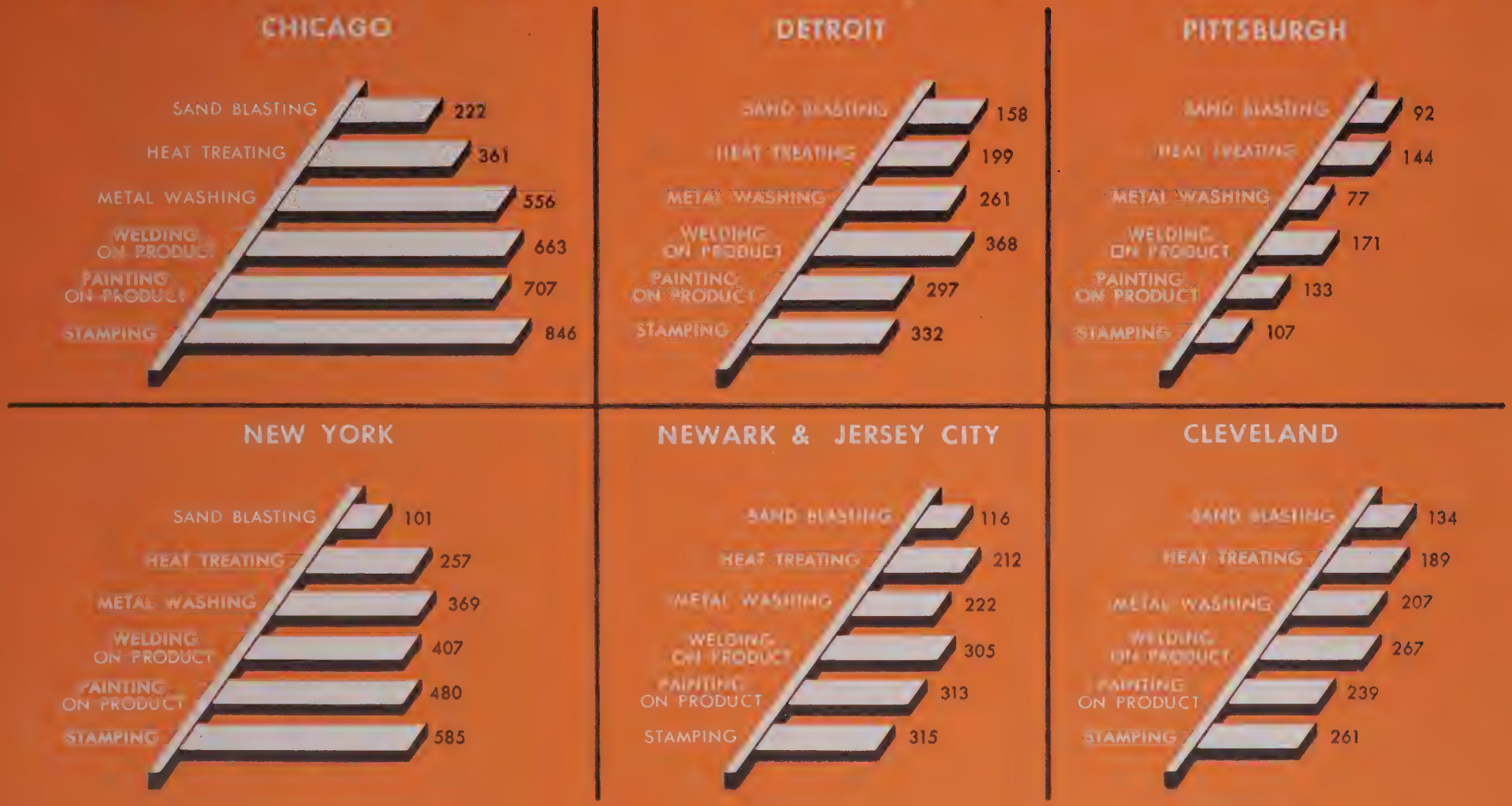
WORKERS IN CHIEF INDUSTRIAL AREAS SHOWN IN IRON AGE DATA

Selected data on employment and types of work performed in principal industrial areas, based on the new Iron Age Basic Market Data Study of the postwar metal-working industry are given in this article. The complete market study, available on request to the Iron Age Research Department, gives employment breakdown by plant size and extensive data on types of departments operated in these plants.

EACH SYMBOL EQUALS 20,000 WORKERS
(Figures Are in Thousands of Workers)

	Furniture & Fixtures, Metal	Primary Metals	Fabricated Metals	Machinery (Except Electrical)	Electrical Machinery & Equipment	Transportation Equipment	Instruments and Photographic Equipment	Miscellaneous	Total Workers
CHICAGO	9.5	64.7	81.1	111.0	105.2	44.9	14.1	15.5	447.4
DETROIT	0.9	33.5	46.2	56.5	6.9	248.2	2.8	2.8	397.9
PITTSBURGH	0.2	137.9	31.5	20.0	33.1	13.5	2.7	2.4	241.4
NEWARK & JERSEY CITY	3.4	22.5	28.4	45.1	69.2	40.8	5.6	14.2	230.1
CLEVELAND	0.9	51.3	41.5	50.0	21.8	32.6	2.2	2.1	202.4
NEW YORK	5.0	7.5	31.0	23.4	35.9	39.9	15.6	12.5	171.0

TYPES OF WORK DONE IN KEY AREAS GIVEN IN MARKET STUDY



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iron ore

The reign of the fabulous Mesabi is ending. 1960, perhaps earlier, will see the end. U. S. dependency on foreign ores is a reality. How and when this Mesabi tonnage will be replaced is told in this objective survey of the steel industry's No. 1 problem.

By W. A. LLOYD
Cleveland Regional Editor,
THE IRON AGE

Accelerated by the ascendance of Mars and the fabulous tonnages of the postwar period, the coming iron ore shortage is casting sombre shadows of dependence, for the United States steel industry, on foreign sources of supply.

Time is running out. The shortage will arrive by 1960, when the bulk of the high grade, open pit iron ore of the Mesabi range, cornerstone of cheap steel in the United States, will be gone, unless action is taken in the interval to keep part of this tonnage in the ground as a strategic reserve. And this is entirely possible.

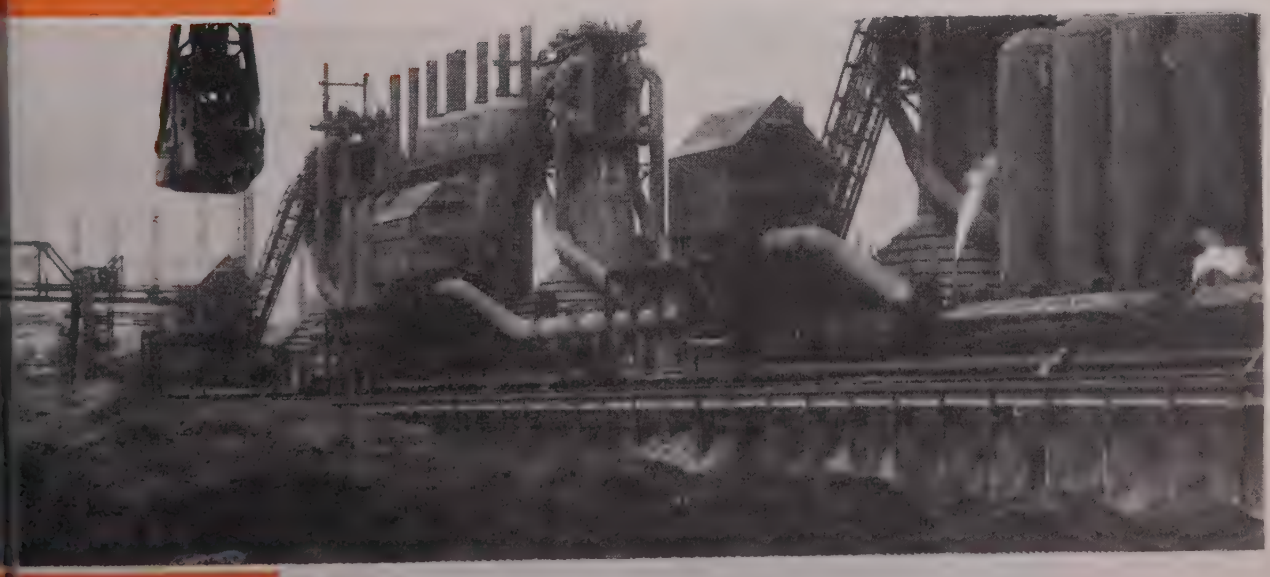
Recently, when word got out that U. S. Steel Corp. was checking up on its magnetic taconite reserves in the Lake Superior district, even those on the fringe of the iron ore shortage began to suspect that the era of wonderful nonsense regarding the Mesabi range was at a quasi-official end.

If further confirmation were necessary, public announcement late last fall that U. S. Steel Corp. holder of the lion's share of the remaining high grade reserves in the Mesabi, had entered into an agreement with Venezuela to mine part of the substantial iron ore reserves of that country, practically clinched it.

A special report on the Mesabi range, and the Lake Superior district, prepared for THE IRON AGE by John W. Gruner, department of Geology and Mineralogy, University of Minnesota, indicates that the steel industry is not moving prematurely toward new sources of supply and that the Mesabi is no longer the iron ore Garden of Eden.

He points out that any geographical shift in the sources of ores away from Lake Superior and the water route of the Great Lakes would necessitate revolutionary shifts in the industrial set-ups and in the population centers of the country.

We have used, according to Prof. Gruner, more than 2,490,000,000 tons of Lake Superior iron ore at the present time. Of this tonnage, 1,600,000,000 tons were from the Mesabi range alone. Estimates to the nearest 10,000,000 tons, based on reports of the tax commissions of Minnesota



and Michigan and brought up to date by Prof. Gruner to the end of the 1948 shipping season leave about the following official reserves: Mesabi range, about 860,000,000 tons; other U. S. Lake Superior ranges, 235,000,000 tons. Prof. Gruner estimated in 1946 that about 300,000,000 tons could be added to the official reserves as of May 1, 1944 for the Mesabi range. He estimates that this amount has decreased to 220,000,000 tons in the five years from 1944 to 1948 inclusive. The total reserves of all Mesabi ores should be in the neighborhood of 1,080,000,000 tons, of which 350,000,000 tons are underground ore. No distinction has been made here between direct shipping ores and those which need beneficiation. Other experts would increase the probable reserves of Michigan from 150,000,000 to about 500,000,000 tons, which would give the following reserves in long tons: Mesabi, 1,080,000,000; Cuyuna and Vermilion, 68,000,000; Michigan ranges, 500,000,000; Wisconsin, 6,000,000; total reserves, 1,654,000,000 tons.

Of this total, about 600,000,000 tons are open pit ores, of which about 96 pct are on the Mesabi range. This ore becomes increasingly difficult to mine and only a few unopened large ore bodies reminiscent of the Missabe Mountain and Hull Rust pits are left.

Prof. Gruner believes that the Mesabi range will supply most of the ore for the U. S. for the next 12 years. It is not possible that Labrador and Brazil, either singly or together, could ship before that time tonnages which would be even half the present shipment of the Mesabi.

Prof. Gruner assumes that, based on the total of 12 years, 45,000,000 tons on an average will be shipped each year from the Mesabi, and that 40,000,000 tons of this will be open pit ores.

"These are figures," he adds, "with which many operators will disagree, but which cannot be off more than 10 to 15 pct in either direction for the total of 12 years."

The open pit ores would have decreased to about 125,000,000 to 200,000,000 tons in 1960. The Mesabi range by that time will have lost much of its importance as the nation's chief iron resource, unless taconite is in production.

Taconite rocks may be classified into two groups, dependent upon their state of oxidation. The importance of this division for operators and metallurgists cannot be over-emphasized. Unoxidized or magnetic taconite, a fresh looking gray to greenish rock, contains iron which can be concentrated magnetically. The other type taconite is oxidized, which by stages may grade into ore. Parts of this taconite constitute the so-called "low grade oxidized ores," which at present are subjected to various concentration tests as flotation and roasting. This material is not magnetic before roasting.

The average iron content of unoxidized taconite is about 27 pct, not 30 to 35 pct as is frequently reported. Silica averages 51 pct. It is obvious that material of this composition is not blast furnace ore and never could be unless industry is willing to pay many times as much for pig iron.

According to Prof. Gruner, only certain parts of the taconite can be classified as probable ores. To be more specific, attention can be focused on some particular layers averaging 100 ft in total thickness. This can be traced over a length of 80 miles, but are interrupted in a number of areas in this distance especially where regular hematite ore bodies occur. These layers make up only about one-sixth of the total volume of taconite and, therefore, reduce the often accepted figures of 165,000,000 tons of probable ores occurring to a postulated mining depth of 400 to 500 ft, to 27,000,000,000 tons.

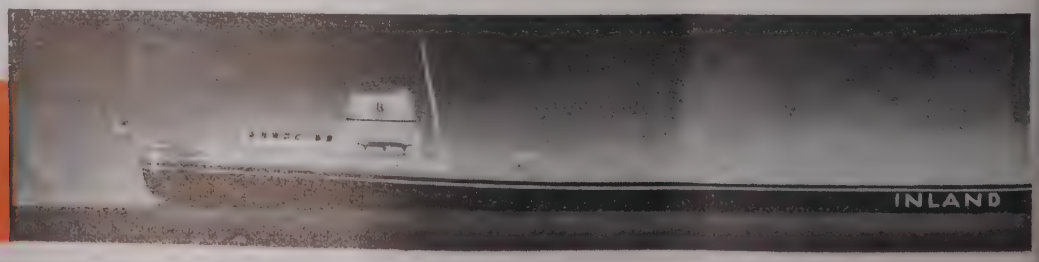
Another important factor in estimating probable tonnage is the fact that these taconite ore layers dip southward under worthless rock layers which would have to be removed to quarry the magnetic ore. Costs of such rock removal would soon become prohibitive. For this reason, open pit mining of such a 100 ft aggregate layer would have to stop at about a 200 ft depth, not counting the thickness of glacial overburden. This limitation introduces another factor of about 5 by which the 27,000,000,000 ton estimate is reduced to 5,500,000,000 tons of probable magnetic ore, equivalent to 1,800,000,000 tons of concentrates.

It is certain that magnetic taconite can be mined economically only on a very large scale and, therefore, only from very large ore bodies measurable in 4,000,000 to 50,000,000 tons at least, for the plant investment is extremely high. Also, the yield of concentrates is only one-third of such figures.

In producing magnetic concentrates from taconite, it is interesting to note that experiments on taconite have been in progress for about 30 years. Lately, a large scale pilot plant has been built. Two of the main problems are drilling and crushing the extremely hard and large-chunked rock. These seem to be largely solved except for cost of the operations. Grinding of the taconite is a most important step. It is controlled by the grain sizes of the minerals and the grade of the product desired.

As the individual magnetic mineral particles are very small, the grinding has to be to a com-

INLAND Steel Co.'s new ore carrier, the S. S. *Wilfred Sykes*, now under construction by American Shipbuilding Co. Keel was laid Nov. 1, 1948, and at present rate



parable size in order to free them from gangue materials, mostly quartz.

Prof. Gruner believes that much could be gained if the furnaces were a little more tolerant with regard to the iron:silica ratio. The ratio demanded today is 63.5:10, which requires grinding in most cases to about —300 mesh. Grinding to —150 mesh produces an iron:silica ratio of about 62:11. Admittedly this adds to the cost of smelting and transportation, but it materially reduces the cost of grinding and handling as well as iron losses in the tailings.

A compromise on this account would be highly desirable and probably will be forced on the furnaces when the regular ores are not obtainable.

There is, however, much magnetic taconite which is so fine grained that no amount of grinding would produce an acceptable concentrate.

Sintering or agglomeration of the finely divided concentrates can be done satisfactorily today, according to Prof. Gruner. The problem of water supply for the large concentration plants is still causing worry except on the east Mesabi range, where fine grinding will be postponed until the ore reaches Lake Superior. There is no completely adequate source of water on either side of the Continental Divide except at the extreme western end of the range about 20 miles from the nearest magnetic taconite body.

Prof. Gruner's conclusions regarding unoxidized magnetic taconites are that the tonnages of magnetic taconite of the whole Mesabi range, minable by open pit, that is, to depths of about 200 to 230 ft, are in the neighborhood of 5,500,000,000 long tons or 1,800,000,000 long tons of 60 to 65 pct concentrates.

If underground mining of this material were economically feasible, the reserve would be a great many times larger. As the regular open pit ores will soon begin to decline and could be exhausted as early as 1965, the magnetic taconites should be opened up as soon as possible to help conserve the regular ores as long as possible for national emergencies.

The tonnages of individual, continuous deposits vary from some containing more than 500,000,000 tons to others around 50,000,000 tons. Plant units of 2,500,000 annual tons of concentrates have been mentioned. Such a unit would exhaust a 50,000,000 ton taconite body in about seven years. It is evident from this that it will take about 150,000,000 tons to supply one plant for its life span.

It is also evident that if taconite alone has to supply the iron units which the steel industry is getting from the Mesabi at present, it would all be used up in about 50 years, except for the underground magnetic ore.

For this and other reasons, Prof. Gruner does not believe that production will exceed 100,000,000 tons or 33,000,000 tons of concentrates a year when the taconites finally replace the regular open pit ores.

Such tonnages would represent twice the present volume of ore and rock removal, which is probably all the upheaval a narrow belt of the dimensions of the Mesabi could be subjected to in a single year.

Much experimental work has been done on the non-magnetic taconite and it is known that magnetic roasting, gravity separation and flotation will produce usable concentrates from some portions. Considerable secrecy has surrounded some of the work, particularly flotation.

According to Prof. Gruner, the chief trouble, as in magnetic concentration, is the extremely fine grained character of the material. It is even finer than magnetic taconite because in the natural process of oxidation the iron minerals, already small, were disrupted still further. For this reason losses of reagents and also of iron in the tailings are often very high.

Other complications are introduced by the presence of only partially decomposed clay-like iron minerals which are very hard on expensive reagents, all of which would seem to indicate that a knowledge of minerals has become indispensable in the mining and treatment of taconites in general.

Magnetic roasting has been tried on a fair scale for low-grade ores, but has proved too expensive in comparison with the recovery obtained, according to Prof. Gruner.

In all these processes, crushing and grinding is necessary to the same fineness as in the magnetic taconites, if the original crude ore is hard and compact. The bulk of the material which comes under the classification of oxidized taconite is hard and massive. It is different in this respect from the well-known wash ores of the West Mesabi, which are found in partially leached crumbling form and need little crushing.

No estimates of reserves of oxidized low grade ores can be made, according to Prof. Gruner. It may be assumed that every regular high-grade ore body in the ground is surrounded by oxidized and partially leached taconite, but this transition may be a foot in width in one place and from 50 ft to 200 ft in another.

"It would be wrong to conclude that all oxidized material can be made into a satisfactory furnace product. As with the magnetic taconite, only certain groups of layers of the formation

of construction, the carrier may be completed late this fall. Dimensions are: Length, 678 ft; summer draft 25½ ft; capacity 22,500 tons.

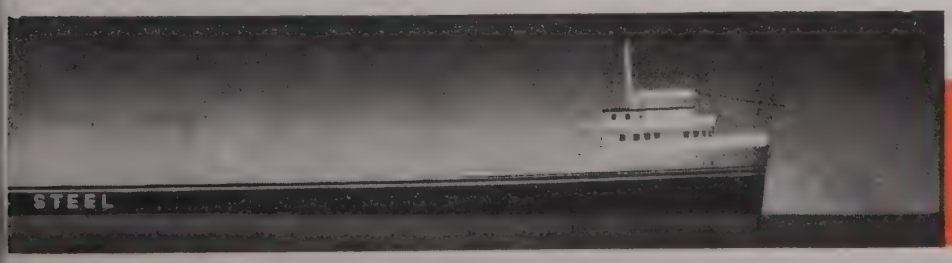


TABLE I

The Iron Ore Picture for 1960
(Flow of Ores to Lower Lake Ports)

Mesabi magnetic taconite concentrates	15,000,000 tons	
Mesabi regular and beneficiated open pit	25,000,000 tons	
Mesabi regular and beneficiated underground	6,000,000 tons	
Total		46,000,000 tons
Michigan, Wisconsin and other Minnesota ranges	18,000,000 tons	
Michipicoten and Steep Rock	4,000,000 tons	
Total		22,000,000 tons
If the St. Lawrence Waterway is completed, Labrador	8,000,000 tons	
Brazil-Venezuela	4,000,000 tons	
Total		12,000,000 tons
Grand Total		80,000,000 tons

will yield suitable concentrates. Others are too fine grained to part with their silica, regardless of the method of beneficiation.

"This fact accounts partly for the discrepancies in estimates of reserves, for hundreds of millions of tons are apparently in sight but only a fraction of this quantity will be usable. Though many millions of tons of this material will ultimately be made into concentrates, they will not change very materially the overall picture of the future of the range."

At the request of THE IRON AGE, Prof. Gruner has outlined the possible iron ore supply line-up of 1960.

He believes that the relative cost of iron ore per unit will be 40 to 50 pct higher than it is today. This rise, he adds, will make the mining of taconite on a large scale a certainty. The flow of ores to lower lake ports in 1960 is outlined by Prof. Gruner in table I.

If the Waterway is not completed, there will be a serious shortage of ore around the Lower Lakes.

By 1970, the taconite concentrates will have increased to 25,000,000 tons, while other Mesabi ores will have dwindled to 15,000,000 tons. Other Minnesota ranges, Michigan, Wisconsin and Ontario will be down to 18,000,000 tons. On the other hand, Labrador and South America will be sending us 14,000,000 tons and 10,000,000 tons respectively. This adds up to 82,000,000 tons.

If these figures seem conservative, Prof. Gruner concludes, the industry will still have New York state and possibly some new developments in Canada to make up any deficiency.

TABLE II

World Iron Ore Reserves by Continent and Category
(Expressed as Percentages)

Continent	Actual	Estimated	Total
North America	15.0%	10.2%	11.8%
South America	20.5	21.9	21.4
Europe	55.5	22.4	33.4
Asia	0.8	30.9	20.9
Africa	8.2	13.4	11.7
Australia and New Caledonia	0.0	1.2	0.8

The change in percentages effected by treating USSR as a separate entity is shown in the following table:

Continent	Actual	Estimated	Total
Europe, excluding USSR	45.1%	14.7%	24.8%
Asia (excluding USSR)	0.0	28.5	19.0
USSR	11.2	10.1	10.5

World Iron Ore Reserves

On paper, there is so much iron ore in the world that complacency can easily result from over-exposure to the figures. For example, Union of South Africa has 2 trillion tons of potential iron ore; that is, ore less than 40 pct iron and high in silica. It seems rather doubtful if this potential ore will be used in any period which can be foreseen at this time, particularly since the Union of South Africa also has about 100,000,000 tons of ore that is more than 60 pct iron and about 6,000,000,000 tons of ore that is from 40 pct to 60 pct iron.

In the present situation, estimates of tonnage are significant, but estimates of availability and productivity are more to the point. Hollinger Consolidated Gold Mines, Ltd., and M. A. Hanna Co. have proved 300,000,000 tons of 55 pct iron ore in their Labrador-Quebec ore fields, which are rapidly turning out to be the 1949 iron ore counterpart of Sutter's mill 100 years ago.

According to reports, Hollinger and Hanna plan to move 10,000,000 tons the first year, starting in the spring of 1953. The deposits in Brazil and Venezuela are too new, from the standpoint of availability, to permit estimates of annual output or export. Furthermore, in Brazil and Venezuela there are political conditions which must be taken into account, which is not the case in Labrador-Quebec.

According to a State Department report prepared by the Office of Intelligence Research, the world iron ore situation shapes up something like this: Total of the actual and estimated iron ore reserves of the world is approximately 93,140,000,000 tons, of which 30,942,000,000, or 33 pct, is actual ore and 62,178,000,000, or 67 pct. is estimated ore.

For general purposes, experts class ore reserves as "actual" if the qualifying terms in the literature describing them indicated substantial exploration and "estimated" if the ore is classed as probable, possible or inferred. A summary of world ore reserves is given in Table II. In this table, when tonnage figures occur in both the actual and estimated columns, the total figure is the sum of the two. Areas of provenance for the large consumers of iron ore have in general higher percentages of reserves classified as actual. This is to be expected because of the necessity of determining quite accurately the reserves available in deposits under exploitation.

While many billions of tons of ore remain in the older steel producing areas, there has been a tendency for industry to reach out into more remote areas for iron ore. In addition to depletion of local reserves, many factors, including

transportation costs, limitations of mining facilities and a desire for ore of certain grades or chemical composition accounts for the trend toward use of ore from distant sources.

In the future it is expected that deposits in Latin America will become increasingly more important as sources of iron ore for the United States, while Africa and Latin America will probably assume greater roles as future ore sources for Europe.

In South America by far the greatest preserves of iron ore are in Brazil. In North America, the chief areas of concentration are Cuba, Lake Superior district and Alabama. African reserves are concentrated principally in Union of South Africa. European reserves are found chiefly in France, United Kingdom, and Sweden. USSR resources are confined generally to the European portion of the country. India and China have most of the Asiatic resources.

While changes in the broad distribution are not expected in the near future, further research in unexplored regions should reveal new deposits. A noteworthy example of this gradually altering pattern is the discovery in 1936 of iron ore deposits in Labrador and Quebec.

Considering those iron ore deposits within economically feasible range of the United States, the situation looks something like this: Developments in the Quebec-Labrador area and at Steep Rock suggest that Canada will have important reserves of high grade iron ore. Further development of the Quebec-Labrador area will probably result in larger estimated tonnages.

Mexico: As of 1947, only three mines were producing in Mexico in the Durango region. Latent possibilities for the exploitation of other deposits may exist, but Mexico is essentially dependent on imports.

Cuba: Large deposits in the eastern part of Cuba have been under production at various times, but the mediocre grade of the ore has not favored their active participation in the world market. However, the deposits have future possibilities as a supplementary source of ore for the United States.

Venezuela: The El Paso deposit is now being developed as a source of commercial ore.

Chile: Total iron ore reserves of Chile are estimated at 440,000,000 tons with an average iron content of 65 pct, but detailed information is scanty. Production has been about 1,500,000 tons annually, of which 90 pct has been exported to blast furnaces, primarily Bethlehem's on the Atlantic coast of the U. S. The remaining 10 pct is utilized by local industry.

Brazil: Ranks first in the world with 19,662,000,000 tons of iron ore reserves. The iron producing district of Minas Geraes has never been thoroughly explored for the purpose of estimating the iron ore reserves, and any figure is tentative and subject to revision, but resources are large and high in iron content, although present production constituted only a minor percentage of world output. Chief problem of exploitation is one of transportation. The Amapa deposits, a district in which M. A. Hanna Co. was once active in exploration, indicate the presence of iron ore of exploitable grade but climate, labor and shipping are important factors here.

CAUE Peak in Minas Gerais, the largest iron ore operating property in Brazil. Ore shipments from this property in 1948 are estimated at 360,000 metric tons. In left background can be seen Conceicao Peak. Each of these two peaks contain an estimated tonnage of somewhat over 100 million tons of hematite, average probably over 65 pct iron.

It should be noted that USSR ranks second in the world in quantity of iron ore reserves, with an estimated total of 9,774,640,000 tons, of which 35.4 pct are classified as available for industrial exploitation. Six or eight large deposits, currently in production, account for 55 pct of the total reserve tonnage. One-half the reserves in these deposits, or 25 pct of the total, contain over 50 pct iron, while the remaining half contain an average of 38 pct iron. Of the total reserves another 25 pct are so low in iron content that they would probably not be utilized except under unusual or extreme conditions.

Deposits are widely distributed throughout the

country, but the major producers of the greater part of the high grade reserves are situated in the Ukraine, Crimea, and the Ural Mountain region. Approximately one-fourth of the total reserves are located where exploitation would encounter difficult labor, climate and transportation problems.

Major companies of the U. S. iron ore industry today are moving to prevent an iron ore shortage. Should the iron ore situation ever reach a point where a segment of the industry could no longer continue operations and be forced to sell or otherwise drop out of the business solely for want of iron ore, nationalization would have a powerful entering wedge.

In the meantime, iron ore reserves in the Lake Superior district are not in consumers' hands in proportion to their needs. It is likely that some companies will need new sources of iron ore sooner than others.

TABLE III

Ore Consumption vs Steel and Pig Iron Production

	1942	1943	1944	1945	1946	1947	1948
Ratio (in tons) of ore consumed to pig iron produced	1.54	1.54	1.51	1.47	1.45	1.45	1.44
Ratio (in tons) of ore consumed to steel produced	1.09	1.09	1.06	1.01	1.01	1.03	0.98

U. S. Steel Corp. has been selling iron ore to other steel companies for a number of years, but it is understood that no contracts for the sale of iron ore will be renewed after 1952. This situation, however, may be subject to change, and in a sense, it raises the question of how important can iron ore get?

Thus, U. S. Steel Corp. has an agreement to mine some of the deposits of Venezuela, and is reported negotiating for an agreement to mine iron ore in Brazil.

M. A. Hanna Co., which owns a substantial interest in National Steel Co., is a partner in the Labrador-Quebec development.

Also examining ore deposits in the Labrador-Quebec area, southwest of the Hollinger-Hanna holdings, according to reports, is another group headed by Cleveland-Cliffs Iron Co. and Steel Co. of Canada, and including Republic Steel Corp., Wheeling Steel Corp., Armco Steel Corp., and Bethlehem Steel Corp.

Oliver Iron Mining Co. has been reported interested in the Quebec-Labrador area.

Steep Rock is starting the second mine in a series of six. The present mine is a 1,000,000-annual-ton mine, but the second mine is expected to be about twice that size, or a 2,000,000-annual-ton mine. The third mine to be opened up will be a 5,000,000-annual-ton mine, with two additional 2,000,000-ton mines and another perhaps 5,000,000-ton mine. The Steep Rock property covers 8000 acres, and will eventually produce, according to Steep Rock spokesmen, 10,000,000 tons a year. In theory, at least, this annual tonnage could be attained in three years' time, in an emergency.

But with the exception of the Canadian deposits, all foreign ore from the transportation angle, is vulnerable in time of war. A group of ore carriers could, presumably, be convoyed at considerable cost.

For this and other reasons, not the least of which is the geographical location of the steel industry at the present time, the taconite beneficiation program merits immediate action.

Research men are saying that 20 years is not too long a time to solve the mass production problems of taconite beneficiation. But the evidence suggests that the taconite industry will have to be on its feet and producing within 10 years' time.

Reserves of magnetic taconite in the Lake Superior district are controlled principally by three companies: U. S. Steel Corp., Oglebay, Norton & Co., and Pickands, Mather & Co., which already has a pilot plant.

To date, most of the efforts toward improvement of marginal or submarginal ores by U. S. Steel Corp. have been in the direction of refinement of wash ores, and not the fine-grind taconites.

Oglebay Norton & Co., which manages Reserve Mining Co., has plans for a 2½-million ton beneficiation plant, locations, and most of the legal red tape cleaned up.

Some observers think it possible that the taconite beneficiation program took a little set-back when Butler Brothers sold out to M. A. Hanna Co. and a group of steel companies, including Inland Steel Co., Armco Steel Corp. and Wheeling Steel Corp. Hanna has tonnage, of the open pit variety, on the range and its interest in Labrador as well. Therefore, there is not the compulsion in regard to beneficiation that some companies feel.

Some observers are of the opinion that 35,000,000 annual tons will be about the best the magnetic taconite beneficiation industry will ever do, for several reasons, including the available taconite tonnage.

In any event, were the taconite beneficiation industry started next week, it would require at least five years to reach the point where it would be producing 20,000,000 tons annually.

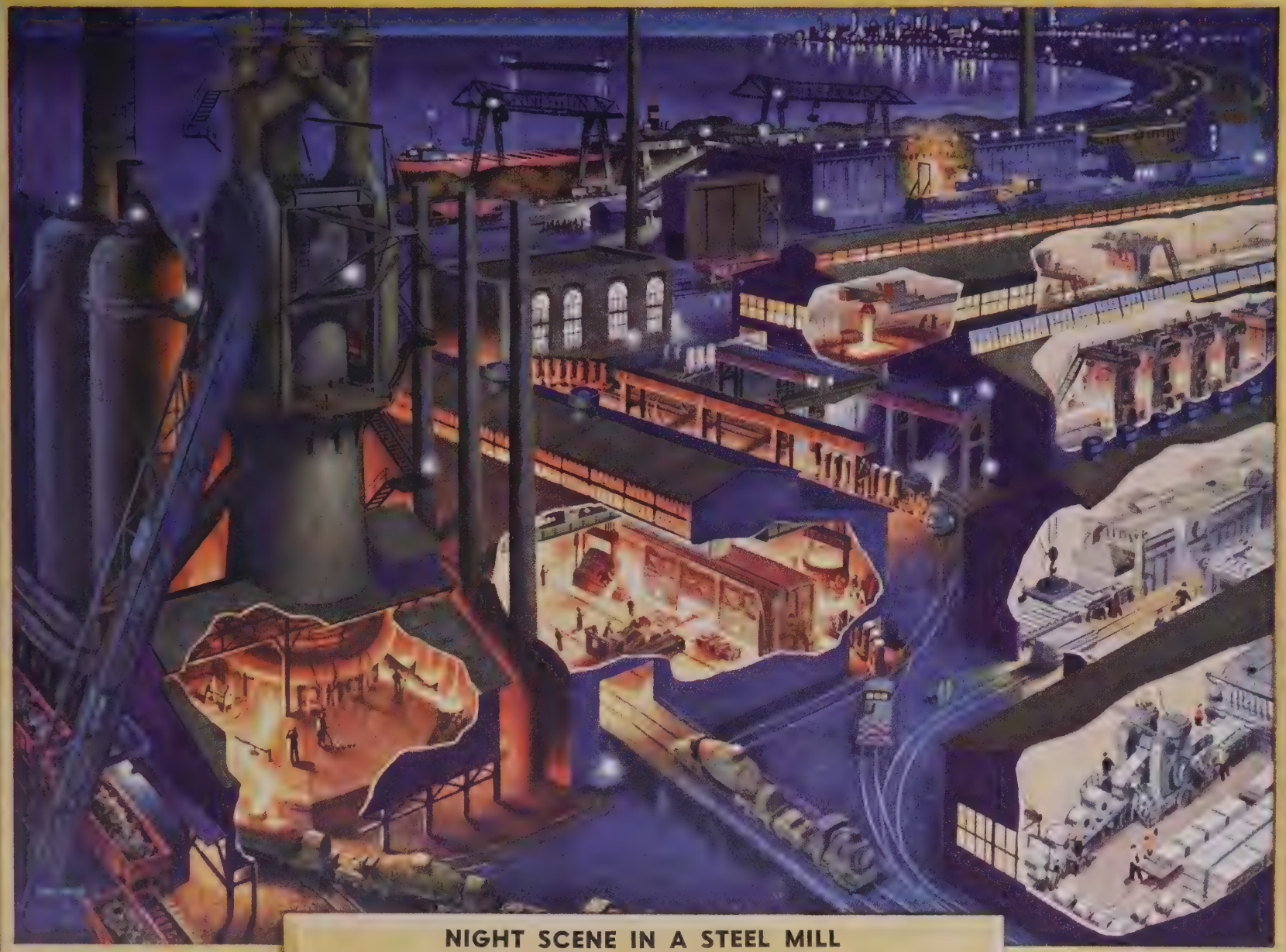
Even in terms of the future scarcity, present costs are important. It has been estimated that to build a 2,500,000-ton (annual) taconite beneficiation plant would require $48,000,000 to $50,000,000, including docks, etc., the second unit of 2,500,000 tons would cost at least $20,000,000.

Taconite's proponents claim that eventually the concentrate produced by the new industry on the range will be produced for about 50 cents a ton more than underground ore, on the basis of iron units.

That this position has adherents with funds and faith is indicated by the fact that the pelletizing pilot plant owned by Reserve Milling Co. and Armco Steel Corp. will get into production within the next few months. Pelletizing may be done eventually for 60 to 70 pct of the cost of sintering.

Investment costs of beneficiation are similar to those entailed by opening up new foreign de-

(CONTINUED ON PAGE 237)



NIGHT SCENE IN A STEEL MILL

Night scene in a typical integrated steel mill, showing processing steps from the ore and coke through the finishing mills. This illustration prepared by Armstrong Cork Co., in cooperation with American Iron & Steel Institute.

The Iron Age

(CONTINUED FROM PAGE 234)
posits. At the start they are tremendous and bear little return; a steel company cannot get into taconite or foreign ore in a small way.

The question of government financing for the taconite program is moot, many in the industry are against it because of the possible threat of nationalization. But few steel or iron ore insurance companies could put up the amount of money it will take to put the plants on the Mesabi range.

Steel men, more than acutely aware of the prince and pauper nature of the business, shudder at the enormity of the capital expenditures required for beneficiation of the taconite and much of the foreign ore for a period when demand is relatively uncertain. Nobody can be absolutely certain what the demand for steel will be in 1960, but in spite of this, the arguments for this expansion of ore supplies outweigh the arguments against it.

But despite the fact that the industry can't get into these projects in a small way, it is going ahead. There are signs that the program is slowly taking shape. In 1947, more than 25 pct of the iron ore shipped from Minnesota was beneficiated in one form or another, mostly washing, and, as table III indicates, the ratio of Lake Superior ore consumed to steel produced is 0.98, lowest in any recent period. This is also the case with pig iron, indicating that more steel and pig iron is being produced from other than Lake Superior iron ore.

A highly strategic factor in the preservation of the Mesabi and its possible future function as an emergency reserve is the controversial St. Lawrence Seaway.

Opposition to the St. Lawrence Seaway is crumbling. Powerful men, some of whom, like George M. Humphrey, president of M. A. Hanna Co., once opposed the Seaway, but are now on record in favor of it. C. M. White, president, Republic Steel Corp.; Crispin Oglebay, president, Oglebay, Norton & Co., and Frank Purnell, president, Youngstown Sheet & Tube Co., now favor the project.

Purpose of the Seaway, which has been kicking around since 1897, is to remove the remaining obstructions to deep-water navigation between the Great Lakes and the lower St. Lawrence River, permitting the passage of deep-draft ocean vessels from the Atlantic Ocean to Great Lakes ports and the passage of large lake freighters from lake ports to ports on the lower St. Lawrence Seaway.

Navigation between the Great Lakes and the lower St. Lawrence is now restricted to small vessels because of the 14-ft maximum draft of the canal system maintained by Canada around the rapids on the St. Lawrence River. The completed waterway will establish a minimum depth of 27 ft over the entire 2347 mile route from Duluth on Lake Superior to the Gulf of St. Lawrence.

Of the 18 large locks required to overcome the 600-ft difference in water level between Lake Superior and the ocean, No. 9 and No. 8 are completed. In 1941 an executive agreement was signed with Canada to promote the project. A resolution approving the agreement was favorably reported by the House Rivers and Harbors Committee in November 1941, but was deferred as a result of Pearl Harbor. Efforts were renewed in 1943, 1944 and 1946, to obtain legislative approval, but for various reasons final approval was not obtained.

Current legislation authorizing the project was introduced in the Senate in 1947 by Sen. Arthur H. Vandenberg (R. Mich.) with the cosponsorship of a bi-partisan group of 15 senators (S.J. Res. 111) and in the House by Rep. George A. Dondero (H.J. Res. 192). These resolutions are companion measures, and are generally similar to previous resolutions authorizing the executive agreement, with one highly significant point of departure: The new resolutions contemplate converting the navigation venture from a public works project into a project which can and would be self-liquidating by means of toll charges on traffic and passengers.

The most recent authoritative estimate of cost is based on data supplied by Lt. Gen. Wheeler, Chief of Army Engineers, with certain adjustments to bring Canadian costs up to date. The Senate Committee's estimate of total cost of the project, including expenditures to date and based on May, 1947, construction cost levels, amounts to $884,000,000, of which the U. S. share would be $523,000,000 and Canada's share $361,000,000. Inasmuch as Canada has already spent $133,000,000 and the U. S. $32,000,000 on existing works comprising integral parts of the project, the cost to complete the project is estimated at $720,000,000, of which the U. S. share would be $492,000,000 and the Canadian share $228,000,000. The Seaway will probably be the iron ore turnpike of the future.

The pending U. S. legislation excludes from self-liquidation the part of the work done in the past on the grounds that these expenditures have served and will continue to serve Great Lakes shipping, even though the works will form an integral part of the Great Lakes-St. Lawrence Seaway system. Cost to be liquidated, therefore, is the cost of new work only.

On this basis, the actual payments for the power facilities by the State of New York to the U. S. government and by the Province of Ontario to the Dominion Government would represent the proportion of total cost liquidated by power and the remainder would constitute the proportion to be liquidated by charges against navigation.

Payments for power are estimated by the Senate Foreign Relations Committee as roughly $161,000,000 each for New York State and the Province of Ontario. Accordingly, the costs chargeable to navigation for the purposes of self-liquidation would be the total cost of new work or $720,000,000 minus the payments for power, $322,000,000, or $398,000,000, of which the U. S. share would be $330,000,000 and the Canadian share $68,000,000.

Army Engineers calculate the annual navigation charges for the project by adding interest during construction at 3 pct for 3 yr to the first cost of the navigation works. By following this procedure, the Senate Foreign Relations Committee calculated the net investment in navigation at $434,000,000.

Applying to the net investment the Army Engineers' formula of interest and amortization at 4.33 pct and annual maintenance and operating costs of $2,460,000 yields total annual charges against navigation of $21,260,000 of which the U. S. share would be $16,840,000 and Canada's $4,420,000. This is the amount of toll revenue required to make the navigation works self-sustaining and self-liquidating.

In addition to the above estimate, the Senate Foreign Relations Committee established a low range of annual charges by using an interest rate of 2½ pct, which is closer to the actual rate at which the U. S. government borrows money today, and a sinking fund of 1 pct and 2½ pct compound interest. This results in reducing annual charges to $17,448,000, of which the U. S. share would be $13,677,000 and Canada's $3,771,000.

Benefits of the Seaway project are national security, navigation and power, the last of which is currently in short supply in virtually all major and minor industrial centers in the U. S.

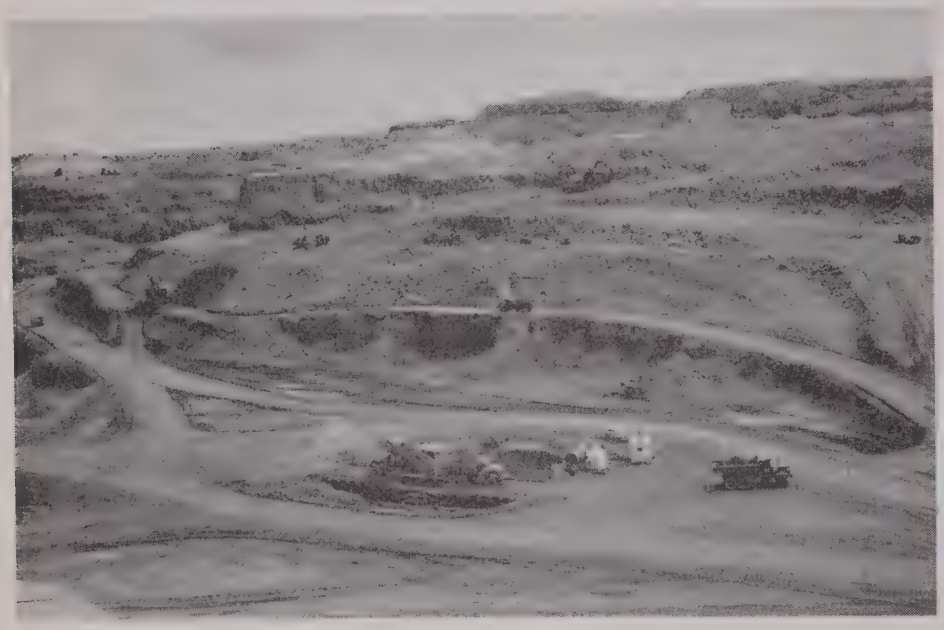
Long proponents of the project as a factor in national defense, if nothing else, are President Truman, former President Herbert Hoover, the late President Roosevelt, Secretary of State Marshall, the Joint Chiefs of Staff, and Secretary of War, Kenneth C. Royall.

The big question as far as the Seaway is concerned is how can the Seaway help national security by permitting the importation of iron ore when one of the greatest dangers to national security is thought by some to be increased reliance on foreign sources for the important raw material?

The charge that the Seaway will act as a deterrent on commercial production of taconite implies the admission by the domestic ore industry that taconite at the present stage of technological development cannot compete with low-cost foreign ore. From this standpoint, it is true that the Seaway will inhibit production of high cost ore from taconite. On the other hand, the real deterrent is not the Seaway but the high cost of taconite production.

Whether the Seaway is built or not, taconite will still face competition from foreign ore, because of the former's high costs of production.

Without the Seaway, a number of experts have predicted a gradual migration of sections of the Midwest steel industry to the coast in order to take advantage of low cost foreign ore.



TYPICAL of the ore deposits which may have to be studied in connection with the establishment of emergency ore reserves for future use is this Hull-Nelson open pit mine near Eveleth, Minn.

If taconite ore cannot compete with foreign ore via the Seaway in the Midwest, it most certainly could not compete with foreign ore at the coast where it would suffer the further disadvantage of a costly rail haul from the lakes area.

Finally, it might be pointed out, the Seaway capacity limits the amount of foreign ore to less than half the peak requirements of the Midwest steel industry. Remaining requirements can be met by taconite concentrate if low cost methods of production are developed.

At the present time, it seems likely that the Seaway will come, but the question is how soon? The Seaway is a five-year construction project. If it were started this year, it would probably be open to traffic in 1955, or about in time to be of help to the iron ore consumers, and the maintenance of reserves on the range.

At best it will be several years before any large tonnage of concentrated taconite can be produced. The steel industry and the country as a whole will be extremely fortunate if the number of such concentrating plants can be increased sufficiently rapidly to take the place of the present open pit ore bodies when they reach exhaustion.

When it is remembered that the shortest lived ore supply is that from the open pits, and that it is this which must be largely or wholly supplanted by concentrated taconite, the vital importance of success in the concentration experiment is apparent.

The capacity for greatly increasing production from open pits has led to the suggestion that the Federal government should acquire the open pit mines and hold them as a war reserve. The total of such tonnage is about right for the purpose. The suggestion seems attractive until it is studied more closely and its effect on peacetime steel production is examined.

Such a move on the part of the government would immediately cut necessary ore supplies for steel production nearly 60 pct of the annual Lake Superior production, or by half of the total yearly iron ore production of the United States.

There is no possible source from which ore could be supplied to replace the Mesabi open pit production without advance notice of six or eight years or more. Without this open pit ore, steel production would be cut to approximately half the present tonnage. The catastrophic effect of such a contingency on the general business of the country is unthinkable.

The ore from the open pits must be used to keep up steel production until the great plants yet to be built to concentrate taconite can assume the burden. When this time comes it is quite unlikely that sufficient open pit ore will be left to make an adequate war reserve. So it is apparent that the suggestion of taking open pit ore as a war reserve is unworkable.

In any future war emergency, this great capacity for rapid, easy expansion will no longer exist. Iron ore supplies will have to come from underground mines, and from vast, costly concentrating plants. Neither source will be able to greatly increase production over peace time capacity. The concentrating plants will be expensive to build and operate. Efficiency will require capacity operation. Idle excess capacity to produce double the normal demand would be uneconomic and would make our peacetime iron ore supply unduly expensive.

A secure supply of iron ore for a war emergency must lie within our own borders. With the changed conditions that face our future iron ore supply there seem to be only two alternatives that will assure adequate quantities.

First is the accumulation of adequate stockpiles of iron ore, scrap, pig iron or steel.

The second alternative is for the government to build or otherwise provide great standby plants of adequate productive capacity for concentrating taconite on the Lake Superior ranges.

There are obvious advantages of stockpiling over standby concentrating plants. Stockpiles would be immune to serious bomb damage, while concentrating plants would be among first priority bomb targets. Stockpiles would be located in steel plant areas, with the production and transportation costs paid at peacetime rates. They would be available even though the enemy had been able to destroy the great locks at Sault Ste. Marie and so stopped for possibly a year nearly all Lake Superior shipments. Even though stockpiles might cost more than concentration plants, they would not deteriorate as would the plants.

When time proves that the United Nations can be accepted as a safe guarantee of peace between the nations, stockpiles would be much more valuable industrial assets than depreciated and possibly obsolete concentrating plants.

VIEW of the Casa de Pedra ore property belonging to the Brazilian National Steel Co. It is one of the two Brazilian ore fields developed to any extent.

research

Skyrocketing costs of industrial research, combined with urgent need for process and product development programs to sustain competitive relationships, is confronting industry, particularly small plant management, with a serious problem. This article outlines a yardstick for determining the size of appropriations for research and suggests how a small plant may economically undertake such programs.

By T. S. BLAIR
Associate Editor,
THE IRON AGE

Is the war-taught lesson of the value of organized, concentrated effort in research and development being ignored or forgotten in the bustle and prosperity of a record peacetime production? Is the increasing cost of research preventing small and medium size plants from participating in and enjoying the eventual benefits of development work?

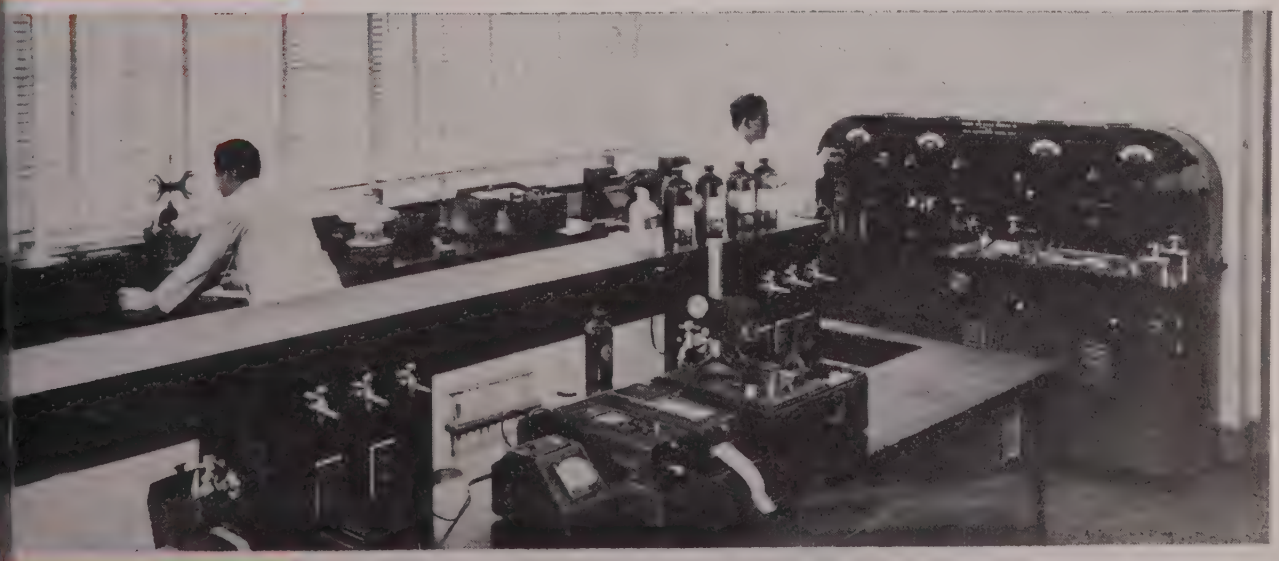
These problems, and others, must be faced by management today, for the war indisputably demonstrated that research is no longer an old toolroom or attic converted into a puttering ground for amateurs. It has become a matter of arming teams of trained specialists with expensive instruments to probe the problems of both basic and applied research.

The expense of mass spectrometers and electron microscopes and the salaries of the experts equipped to use such tools tend to screen out and frighten off companies with limited budgets. As a result, surveys and statistics show the great bulk of the country's industrial research effort to be carried by the large corporations, to their ultimate advantage and further growth. In 1938 nearly one-third of total research personnel was in the employ of only 13 companies[1]; and in 1940, 70 pct of the personnel was employed in companies having tangible net worth over $10 million each, with roughly half of the 70 pct being employed by the companies with net worth over $100 million.[2]

The whole trend poses the question of whether there is an unavoidable tendency toward the large corporate form capable of supporting the men and equipment for modern research.

Under present conditions the answer is negative, for the small company has outside facilities and experts equipped to tackle research on its behalf just as effectively as the large corporations' laboratories. The small company has fewer products and processes requiring development than the large corporation, and in theory, by diverting the same proportion of gross sales income to research can maintain its competitive position.

Executives in many small plants are aware of the necessity of research for the industrial health of their companies, but are not certain of how



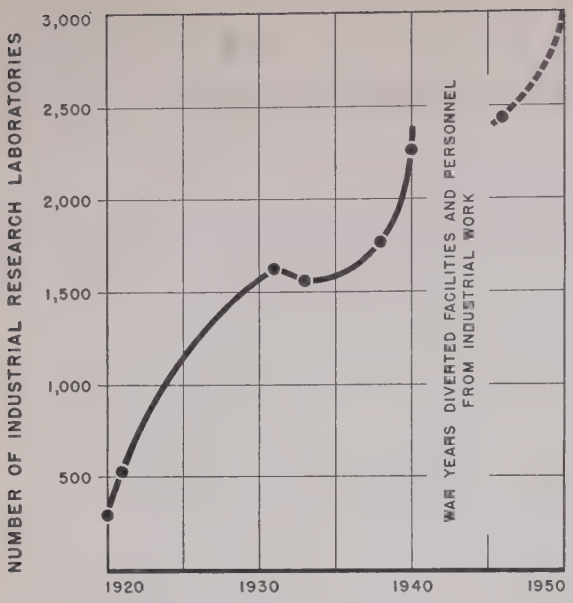


FIG. 1—Growth in the number of industrial research laboratories. Statistics from bulletins of the National Research Council.

much money should or need be spent for research or how to go about setting up a program.

Neither dilemma can be generalized or settled absolutely. However, a rough yardstick for expenditure is that a company must divert 1 pct of gross sales income to research in order to maintain its competitive position. Further, if the company is really aggressive and expansion-minded, the figure should be nearer 2 or 3 pct. Such a yardstick cannot be absolute. There are factors affecting each individual company's work and market which make any such generalization rather futile. But one thing is certain. Companies which have been notably prosperous in the past two decades have been and are in many cases plowing back as much as 6 pct of gross sales into research.

Figures substantiating the benefits of industrial research were prepared by the Standard Oil Development Co. on the basis of projects carried out for the Standard Oil Co. of New Jersey over a 10-year period. It was found in this interval that the returns for each dollar spent on research amounted to: Savings in royalties which would otherwise have been paid, $3.72; savings due to improvement in existing processes and products, $9.62; and added profits due to new products, $2.07—a total return per dollar invested in research of $15.41.

Similarly, Johns-Manville Corp. this year reported that 56 pct of current sales income is from products improved by research since 1928. Merck & Co., Inc., in announcing research expenditures for 1946 to have been $3.2 million not including about $500,000 spent in encouraging outside research, credited its 300 pct increase in sales for 1946 over 1939 largely to research and development work.

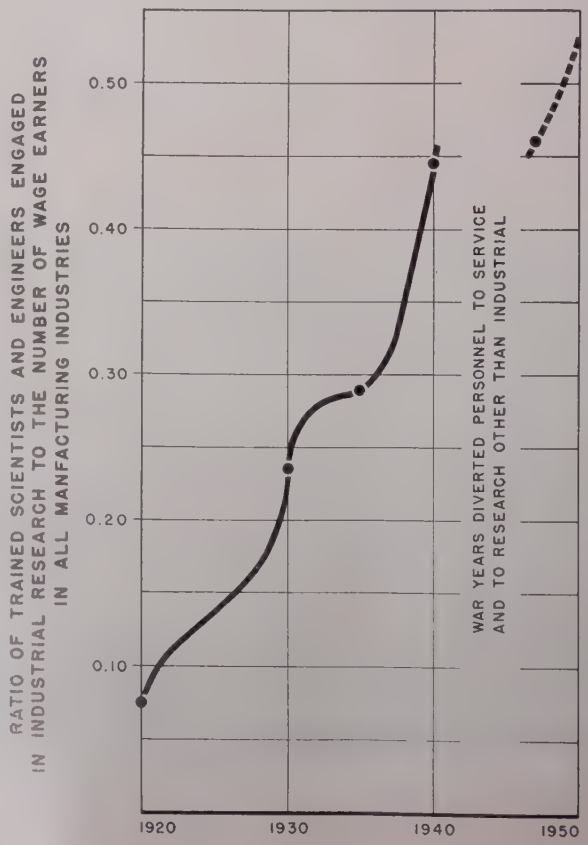
Specifically what are the trends in industrial research against which a company can measure its activities? Fig. 1 shows the growth of industrial laboratories, purely in the number of units in existence. Fig. 2 shows the ratio of trained scientists and engineers engaged in industrial research to the number of wage-earners in all manufacturing industries. This is not a pure numerical growth, it is an increase in the percent of employees engaged in research work, to the point that for every 1000 production workers there are now approximately five research men. Fig. 3 charts the increase in expenditure for industrial research, with one curve showing the actual dollar expenditures and with a second curve, compensated for fluctuations in dollar value, showing a somewhat truer picture of the trend upward.

When dollar expenditures for research are plotted as percent of total value of products, however, as in fig. 4, it is seen that the record peacetime business activity of the postwar period, inflationary factors and other considerations have allowed production in a sense to outgain research activity.

This situation was substantiated in a survey conducted by the National Assn. of Manufacturers.[3] In this survey, the proportion of gross sales spent on industrial research for the 750 manufacturers reporting research programs showed a drop to 1.6 pct for 1947 from 1.86 pct in 1939. However, many of the reporting companies showed an increase in this ratio, and 57 pct of the companies answering a question on plans for future research indicated that expansion of facilities and programs was being planned for the next 2 years, 1948 and 1949.

This ratio of research expenditures to sales would be considerably on the high side if taken as an indication of overall industrial activity, for

FIG. 2—Increase in the ratio of trained scientists and engineers doing industrial research to the number of wage earners in all manufacturing industries.



it is based on the returns only of the 750 companies reporting research programs. In addition, there were 233 "no research" returns which drop the figure approximately 25 pct, and it is likely that the companies not returning the questionnaire at all were for the most part those not emphasizing or participating in extensive research.

To some degree this cutback in the percent of gross sales or value of product being spent for research can be attributed to the current high level of business activity, roughly 150 pct of the 1940 level. The apparent drop can also be partially attributed to the dislocations wrought by the war years when diversion of facilities and personnel to defense projects and production cut back industrial research to approximately a third of the 1940 level.

Table I gives dollar expenditures by industry of the companies replying to the NAM questionnaire, and tables II and III give more detailed information on the primary metal producers and the fabricated metal product companies. Both industries reported the objectives of research to be the improvement of existing products, development of new products, improved manufacturing procedures, new uses for existing products, better raw materials, and salvage of waste material, in roughly that order.

To return to the problem of the small company in setting up a program, three things are essential: (1) It must keep up with new operating practices in its own and other industries; (2) it must periodically consider its products, operations and position and weigh against these the possible advantages to be derived from specific research projects; and (3) it must have at

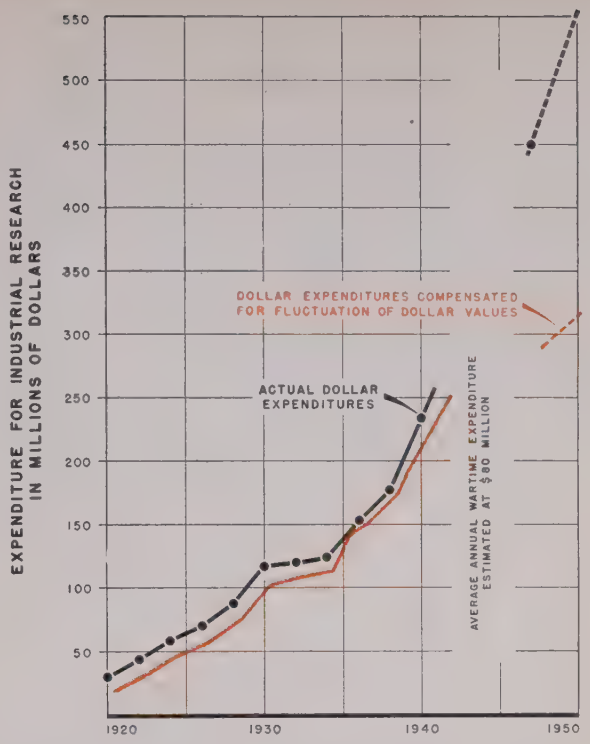


FIG. 3—Increase in expenditure for industrial research. Curve showing expenditure compensated for fluctuation in dollar value has Jan. 1939 as the base.

its service the facilities and experience of a well organized research laboratory.

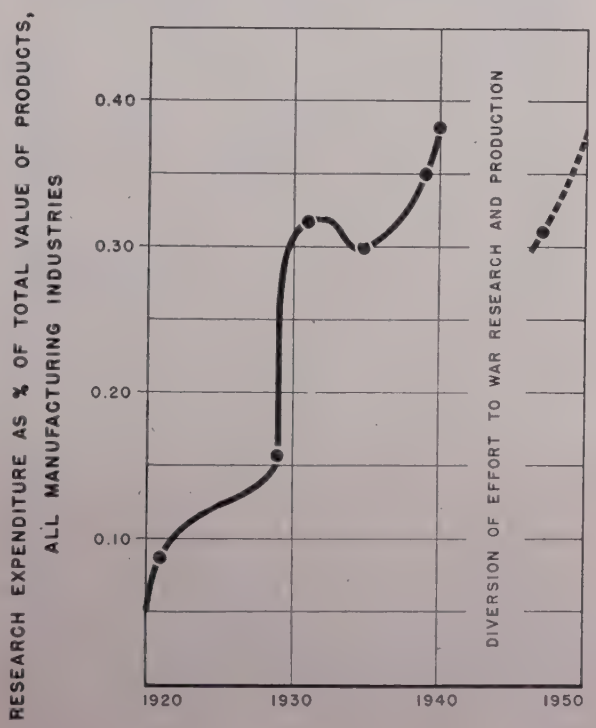
The first two of these requisites usually can be handled, and usually are best handled, by some individual within the company. Where there is no one with the time or background of experience to properly do the job, the services of a consultant familiar with the field can be obtained. Research personnel and laboratory facilities, the third requisite, can be furnished by the commercial laboratories, nonprofit institutes or universities.

In this third consideration there is also the alternative of investing in private laboratory facilities, with perhaps several low-salary technicians to carry out projects under the direction of a consultant. Or, there is still another alternative, namely, cooperative research projects organized and maintained through trade association groups. Since a company bears only a portion of the expense, its research dollar can be made to go a long way. Rather than the development of new or improved processes or the solution of specific problems of individual companies, however, such groups commonly work toward new uses for, or general improvement of, the product common to the member companies.

In any instance where the company decides to turn to outside assistance there must be some one within the company thoroughly familiar with production and with a clear picture of production practicalities to keep in touch with the research effort—to lend the realism of the production aspect to the developmental work and to see that findings are properly applied.

Uncertainty in regard to the deductability of research expenditure as a current charge against

FIG. 4—Dollar expenditures from industrial research shown as percent of total value of products in all manufacturing industries.



net income has been working to a very slight extent against expanded research on the part of the small companies. Deduction of research cost is generally permitted by the Bureau of Internal Revenue and where the amounts are clearly determined and are consistent year after year, there are few instances of claims being disallowed. However, in small and new companies where the amounts are likely to vary widely from year to year and where accounting practice may not be consistent, the Bureau is likely to scrutinize expenditures closely. Proper treatment of research costs is not specifically covered in the tax law and Treasury regulations, and the few court decisions relating to the question back the idea that research costs are capital expenditures. As a result, the small company is overly dependent on continuation of the present liberal policy of the Bureau of Internal Revenue. Further, the likely delay of several years before a return is audited heightens the uncertainty and, as a sizable amount of money for a small firm is often involved, the setup discourages research expansion.[4]

If, after considering its individual problems, the management of a small company decides to embark on a research program requiring outside help, consultants and commercial laboratories, the nonprofit institutes and the universities can be called upon.

The universities have stepped further and further into the industrial research picture. In the latest edition of "Industrial Research Laboratories of the United States," published by the National Research Council, National Academy of Sciences, Washington, there are 292 universities and colleges offering research service to industry listed.

The decrease in endowments and gifts from private individuals and the general need for augmenting the income of the science departments of the universities have largely accelerated the tendency to accept industrial problems. Spokesmen against this trend have raised some valid objections. Utilization of staff time for applied research diverts the staff from its primary purpose of teaching and training the students who are so needed now in filling the manpower demands of expanded research activity. Also, whereas the universities have been a primary seat of basic research, developing the fundamental knowledge on which applied research and progress feed, the acceptance of applied research projects interferes with pure research.

The proportions this trend has assumed are well documented statistically. In the decade from 1930 to 1940, industrial research expanded 100 pct and government research expenditures grew 200 pct while university work increased only 50 pct and expenditures in the endowed institutes doing pure research work actually declined by nearly 15 pct. The ratio of applied to pure research expenditure in 1938 was approximately 6:1.[5] By 1947 this ratio had slipped to 10:1.[6] In the long run a 10:1 ratio is bound to impair this country's technology.

Alternatives for the universities have been suggested. Government support of basic research has been proposed.[7] Increased support by industry is being urged. And the universities themselves have in some cases faced the problem by setting up the industrial service group as an entity separate from the actual university laboratory, but operating for the benefit of the university, and with personnel other than the teaching staff doing full-time research with no university demands on their time.

The nonprofit institutes, especially the larger ones, tend to be more interested in long range, large scale programs than in the specific problems of small plants which would seem to be short term propositions. In many instances, however, routine testing work and product evaluation programs are taken on.

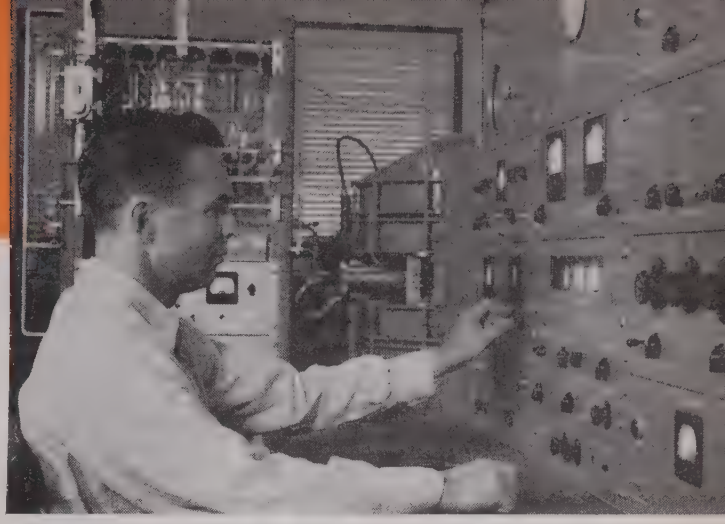
Commercial laboratories are open to any and all problems. In one laboratory of larger than average size, the average project cost has run only $250.

Cost of the work done by the independent commercial laboratory is arranged to be completely under the control of the client company. Work can be arranged at a monthly rate of expenditure, on an overall budget with expenditure limited to some prearranged figure or, in some cases, on a fixed price contract.

The standard procedure is for the commercial laboratory to investigate the problem brought to it; possibly make a literature and patent

ELEVATED temperature strength of titanium metal being tested at Remington Arms Co., Inc.

OPERATOR at the control panel of an analytical mass spectrometer. Photo courtesy of Consolidated Engineering Corp.



survey, suggest the line of research to be followed toward solving the problem and present an estimate of the cost of the research work. This preliminary study will involve a fee, but on the basis of the survey the client company will be better able to weigh the pros and cons of embarking on actual research work.

To demonstrate the type of assistance outside laboratories provide, case histories can be cited. Not all work out as successfully or as simply as most of the examples which will be given. Research often leads up blind alleys and the solution of one problem commonly unearths another or several more. But each step is a step forward, even if it amounts to little more than a demonstration of the insolubility of the particular riddle.

Case A: A foundry producing water meter parts was having difficulty with leakers. The representative of a furnace manufacturer blamed the gas-fired melting furnaces being used, so the foundry went to coke-fired pit furnaces but still had the same trouble. A sand supply man suggested that the trouble was in the sand. Accordingly the foundry scrapped its sand heaps and bought a new stock with the suggested clay content and fineness, but the trouble persisted. A specially prepared carload of ingot metal was tried with no luck. A special flux did not help. Finally an independent laboratory, Sam Tour & Co., Inc., was called in. Representatives of the laboratory spent several days at the plant, took samples of the defective castings to the laboratory for study and returned in a few days with the answer. Many of the pinholes in the leakers were found to have a small inclusion high in iron. An Alnico hand magnet located iron grindings in the foundry's supply of plumbago core wash, and as soon as a fresh supply of wash was obtained, the problem was solved. Cost to the foundry was about $1200.

Case B: Service life of hardened dies used in cupping and folding cardboard cartons at the Charles Weinhagen Co., St. Paul, was running much shorter than was normally to be expected. At a cost of $50 per die, the trouble was expensive. An investigation carried out by Twin City Testing & Engineering Laboratory indicated that the lips of the dies were being cracked during quenching, with the result that service life was limited to the time required to complete the fracture of the die. The laboratory's recommendation was for the company to normalize its dies, since in use against cardboard high hardness is not important. As a result, failures dropped from 5 dies in 3 weeks to a single die in 6 months. Cost of the investigation was $78.

Case C: A manufacturer of chocolate molds had always used an imported nickel-clad thin sheet steel which could be stamped to the desired mold shape and tin soldered. The thin nickel-clad stock was not produced in this country and domestic steel strip electroplated with nickel proved unsatisfactory. An independent laboratory studied molds made from both materials and developed an improved stock for the company. The use of a copper flash plate under the electroplated nickel was eliminated, a heavier nickel plate was applied and a controlled atmosphere anneal after electroplating was introduced to bond the nickel to the steel. This product proved superior to the imported material. Total cost was about $750.

Case D: A very simple problem, as it turned out, which was cited in another study[8] is the experience of a company which was a rather large manufacturer of razor blades. This company, despite all sorts of machine tool investigations and other work, was not able to make blades which would stand up and give good service. One of the commercial laboratories took on the problem and after a very short investigation showed the company that all it need do was turn the strip steel stock so that blades were formed from steel having the grain at right angles to the blade edge rather than parallel to it.

Case E: Sanborn Co., Cambridge, Mass., developed a direct-writing electrocardiograph. The idea was to eliminate the recording of impulses on photographic paper as this necessitated darkroom facilities and a time interval before the heart test could be examined by a physician. The direct-writing method used a heated stylus to record the results on a paper coated with an opaque wax which was rendered transparent by the heated stylus. However, this paper smudged and fingermarked easily, and filing and handling of records proved so difficult that the success of the whole development was jeopardized. Engineers of the company were not equipped to handle the surface coating problem, so Arthur D. Little, Inc., was consulted. Within six weeks, this group developed a lacquer coating which reacted satisfactorily with the heated stylus and did not fingermark. Arthur D. Little, Inc., also arranged for a paper company to make the special coated paper. In its electrocardiograph use the paper

TABLE I

Research Expenditures by Industry
(Source: National Assn. of Manufacturers)

INDUSTRY	Anticipated 1947 Expenditure	1946 Expenditure	Pct Gain 1947 Over 1946	1939 Expenditure	Pct Gain 1947 Over 1939
Primary Metal Industries	$4,308,000	$3,572,286	20	$1,568,140	176
Fabricated Metal Products	6,750,455	6,082,207	11	2,713,063	148
Food and Kindred Products	7,075,336	4,941,503	43	1,606,118	340
Textile Mill Products	2,196,452	1,477,225	49	362,313	505
Apparel	52,000	32,500	60	6,000	766
Lumber and Wood Products	898,000	653,567	38	144,978	520
Furniture and Fixtures	176,500	146,900	20	42,600	320
Paper and Allied Products	3,983,500	3,439,176	16	1,077,982	277
Printing, Publishing and Allied Industries	1,153,500	708,613	63	182,136	530
Chemical and Allied Products	27,624,000	24,890,072	11	5,942,183	382
Products of Petroleum and Coal	47,232,400	39,850,225	19	13,178,000	276
Rubber Products	10,360,065	9,571,360	8	3,772,890	175
Leather and Leather Products	300,250	227,250	32	104,000	191
Stone, Clay and Glass Products	4,670,258	4,247,906	10	1,630,548	187
Machinery (Except Electrical)	18,527,714	14,963,331	23	6,112,584	203
Electrical Machinery, Equipment and Supplies	9,261,500	7,893,326	17	1,285,266	620
Transportation Equipment	45,730,500	44,040,889	4	10,433,333	340
Professional, Scientific and Controlling Instruments	15,589,258	13,268,197	17	5,846,021	165
Miscellaneous Manufacturing Industries	1,494,500	1,444,741	4	182,734	720
Total and General Average	$208,384,188	$181,451,274	14	$56,190,889	270

has proved so satisfactory that Sanborn now plans to use it in a general purpose industrial recorder.

Case F: A bronze emblem manufacturer was having difficulty with failure of the drop dies used. Several tool steel company representatives suggested that only particular tool steels could be used without failure, but this was not successful. A commercial laboratory studied the plant procedures, and samples of failed dies and the emblems being made were taken to the laboratory where tests proved the trouble to be in the grade of commercial bronze used. The bronze was made from scrap raw materials carrying about 0.14 pct Fe, 0.25 pct Ni and 0.15 pct Sn. With these impurities the bronze did not anneal as rapidly or as soft as the purer grades and also work hardened much faster. Proper specification of the raw material ended the difficulty and the total cost of the investigation was under $450.

Case G: A manufacturer of washing machines employed an independent laboratory, Sam Tour & Co., Inc., on a retainer plus laboratory charge basis to assist in general material and production problems. One difficulty involved the breakage of stainless steel spring arms. Studies and tests of various stainless grades after a variety of heat treatments developed the impact toughness curves for these steels from which the optimum conditions for maximum service were established. At an estimated cost of $3000, field breakage was reduced 80 pct with a saving to the company in replacement costs alone of many thousands of dollars. Another problem involved cast iron gears for the washing machines. A soft gray iron was being used for the gears and the life of the cutting tools was limited. On the basis of studies made of the iron and of tool failures, arrangements were made to obtain permanent mold iron castings for the gear blanks. This resulted in a 50 pct increase in cutting speeds, 300 pct increase in tool life and a 35 pct reduction in the net cost of the better finished gear. Charge to the company for this project was approximately $2500.

OXYGEN bombs used in accelerated oxidation studies at U. S. Testing Co., Inc.

Case H: A company making formed low brass parts was using 2 million lb of rolled brass per year and thought it might prove advantageous to put in its own brass mill for this production. For a fee of $1500, a consulting laboratory studied the situation, submitted a layout of the necessary mill, an estimate of its initial cost and of the cost of operation. The figures demonstrated that the installation would not be warranted for the volume of production and what might have been a costly mistake was avoided.

Case I: For a particular type of work an established jobber in special die steels had been importing an English steel, for none of the die steels produced in this country had been found to give as good service. The jobber took the problem to an independent laboratory where the metallurgists examined and tested samples of the imported steel and of domestic steels intended for the same duty. Basic characteristics differentiating the imported steel from the domestic were determined and the laboratory arranged to have several special heats made in this country. These were found to be the equivalent of

the imported steel and the jobber was provided with a quicker and cheaper source of material. Total cost was under $2000.

Case J: A somewhat larger scale program was conducted at Mellon Institute from 1940 to 1948 under a fellowship sponsored by the National Radiator Co., Johnstown, Pa.[9] Originally the program began by investigating the possibility of electroforming iron radiators. This proved impractical, but during the investigation unusual characteristics were noted in the electrolytic iron and attention was diverted to the possibility of making use of these properties in other applications. Electrolytically deposited iron sheet, properly processed, was found to be extremely ductile and to have useful electrical properties. Also if the iron were powdered, it was found to be excellent for use in powder metallurgy, electronics and chemistry. On the basis of the work, methods for producing the electrolytic iron were developed and the Plastic Metals Div. of National Radiator Co. was organized to manufacture and market the iron powders.

Case K: About 18 months ago, Vacuum Can Co., Chicago, contracted with the Armour Research Foundation for fundamental and developmental research on electric water heaters being made by the company. The objective was to develop an improved product from the standpoints of corrosion resistance, strength and life expectancy. Field requirements of the units were studied and the Metals and Electrical Engineering Departments of the Foundation determined the most suitable construction and design for the heaters. Gages of stainless to be used in the component parts, methods of assembly and the electrical equipment to be used were established. The new design was proved by accelerated endurance tests. Final result was that the heater tanks were increased in strength almost three times and all other requirements were satisfactorily met. Cost of the project, originally estimated at $5000, was $3500. The client company is continuing its association with the Foundation for the testing and improving of other products.

Case L: The Corry-Jamestown Mfg. Co., Corry, Pa., a manufacturer of file cabinets, had the problem of cabinet drawers buckling due to overloading. The drawers were designed to carry a load of 60 lb, but after being overloaded with various odds and ends, users often found that the drawers would buckle and would no longer open easily. The company hoped to strengthen the drawers, but at the same time wanted to keep cabinet design intact as a change would mean expense for new dies. The problem was taken to Carnegie Institute of Technology where two mechanical engineers quickly solved the difficulty by changing the gage and thickness of the metal strip which rides on the wheel providing smooth action in drawer opening. This strip was also bent to assure that the wheel would serve as the fulcrum balancing the opening and closing of the drawers.

SPECIMEN being studied under an electron microscope. Photo from Radio Corp. of America.

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[1] Vannevar Bush, "Science the Endless Frontier," p. 101.
[2] National Resources Planning Board, "Research—A National Resource," vol. II.
[3] National Assn. of Manufacturers, "Trends in Industrial Research and Patent Practices."
[4] "Science the Endless Frontier," p. 104.
[5] "Science the Endless Frontier," p. 81.
[6] J. R. Steelman, "Science and Public Policy," vol. I, p. 21.
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[8] Standard Oil Development Co., "The Future of Industrial Research," p. 131.
[9] Mellon Institute, "Meeting Needs of Mankind by Scientific Research," p. 41.

TABLE II

Average Ratio of Research Expenditures to Sales of Companies in the Primary Metal Industries (Source: NAM Survey. Number of Companies Reporting Indicated in Parentheses.)

Estimated 1947 Sales, in Thousands	1947 Ratio in pct	1946 Ratio in pct	1940 Ratio in pct
$100 to $250	1.00 (1)	1.15 (1)	....
500 to 750	0.05 (1)	0.06 (1)	0.07 (1)
750 to 1000	1.80 (1)	2.63 (1)	....
1000 to 2500	0.56 (3)	0.41 (3)	0.68 (2)
2500 to 5000	2.29 (1)	2.71 (1)	....
5000 to 10,000	0.75 (5)	0.74 (5)	1.03 (5)
10,000 to 25,000	0.58 (7)	0.67 (5)	0.99 (5)
Over 25,000	0.32 (8)	0.44 (9)	0.39 (9)
General Average	0.64 (27)	0.71 (26)	0.59 (22)

TABLE III

Average Ratio of Research Expenditures to Sales of Companies in the Fabricated Metal Products Industries. (Source: NAM Survey. Number of Companies Reporting Indicated in Parentheses.)

Estimated 1947 Sales, in Thousands	1947 Ratio in pct	1946 Ratio in pct	1940 Ratio in pct
$100 to $250	7.66 (3)	6.37 (3)	5.79 (2)
250 to 500	5.00 (1)	4.88 (1)	
500 to 750	1.23 (1)	1.14 (1)	0.94 (1)
750 to 1000	1.38 (4)	1.83 (3)	1.82 (1)
1000 to 2500	1.28 (10)	1.10 (11)	1.69 (8)
2500 to 5000	1.03 (10)	1.29 (8)	1.13 (7)
5000 to 10,000	0.73 (8)	0.66 (8)	0.85 (5)
10,000 to 25,000	1.73 (3)	1.53 (3)	1.71 (3)
Over 25,000	0.44 (3)	0.50 (3)	0.54 (3)
General Average	1.64 (43)	1.60 (41)	1.55 (30)

detroit

Girding for one of its greatest battles against soaring production costs, automobile plant engineers are microscopically studying every machine, every material, every processing step in an effort to counteract by technological skill the irresistable increases in labor and material costs. What the likely outcome of this effort will be, in terms of methods and designs, are told in this authoritative analysis of the automobile industry's plans for the future.

By W. G. PATTON
Detroit Regional Editor,
THE IRON AGE

The automobile industry knows its battle against soaring production costs has only begun.

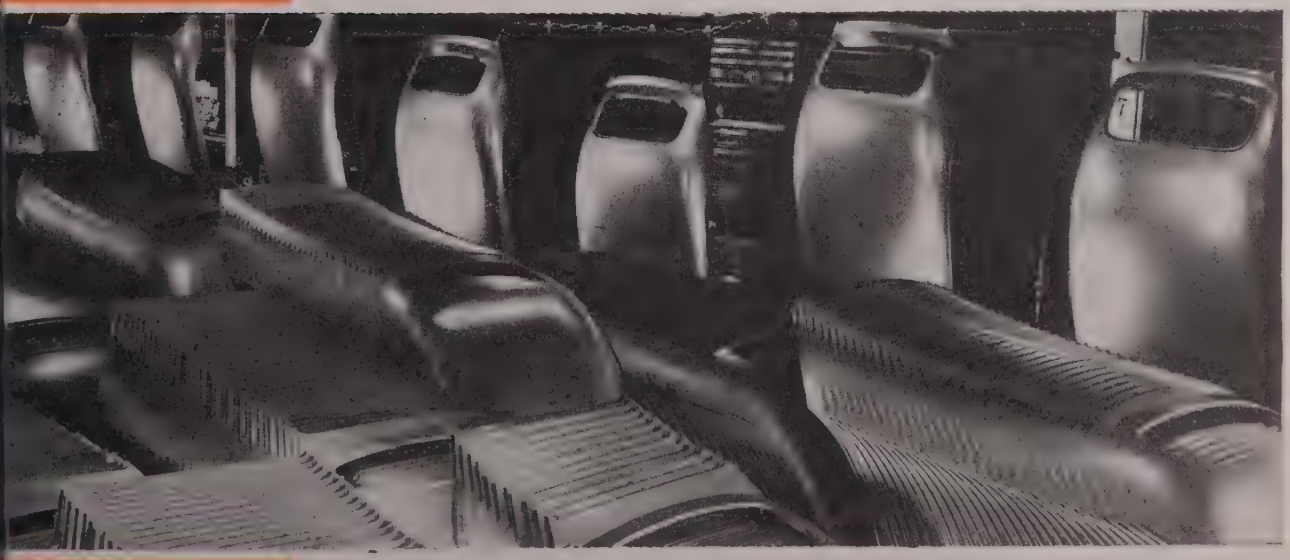
Faced with the longest sustained advance in material and labor costs in the history of the industry, every car producer has his cost records under the magnifying glass. With few exceptions, every material and machine tool and processing method being used in the industry will sooner or later come under the critical eye of the car-makers' process engineers and accountants.

As a result of such studies, the industry has already abandoned or greatly modified many of its prewar tooling and processing ideas. Much of the new equipment has already been bought. Now comes the payoff. If the expected economies are realized, broader acceptance of these new tools and processing methods is sure to follow.

It is evident that the next few years will see feeds and speeds of machine tools boosted tremendously in Detroit. New and improved carbide tools, better tool holders and fixtures and heavier precision-built machines have made these higher cutting speeds possible. If steel is available in convenient forms and sizes, the next year or two will undoubtedly see a substantial increase in the use of progressive dies. Automatic handling of material from one press to another will be employed to improve plant efficiency. Mechanical handling of raw material will be sharply increased with special attention being given to packaging of material and parts.

An organized search for lower production costs is going on at all levels in the industry. General Motors has had such a program for years. This activity, which is corporation wide, is coordinated through the GM Product Engineering Section. Chrysler is similarly engaged in a program looking toward greater standardization and lower costs. The Ford program is probably the most active in the industry at the moment.

Meanwhile, independent car manufacturers know their ability to hold or improve their present position will, in the final analysis, be determined by their success in keeping production costs down. In the case of the in-



dependent producers, particular emphasis is being placed on reducing labor costs. It is recognized that improved utilization and control of manpower probably offers a greater potential for cutting costs than any improvement in tooling or manufacturing methods.

It is generally believed here that car designs are pretty well frozen for the next few years. During 1949, design for the customer will be secondary to design for manufacturing. This is a reversal of the situation prevailing since automobile production was resumed following the war.

Suppliers who have always found the auto industry pushing hard for more and better and cheaper supplies will find such pressures increased.

The auto industry has always leaned strongly toward highly specialized equipment. Transfer-type machine tools are an example. Much of this equipment has been developed jointly by the industry and its suppliers. This trend, which has been at an accelerated pace since the war, is certain to continue even though present buying is light.

Most Detroit observers are convinced that motor cars have just about reached their maximum dimension. Car widths will always be limited by state laws and highway conditions. Garage limitations won't allow cars to be much longer than they now are. Because of restricted freedom in design, all-out efforts are going to be made in the next few years to engineer weight out of the present cars. Reasons of material scarcity and economy of manufacture and lower operating cost will dictate such a move.

Sources here have pointed out that even greater weight reductions than are now possible could have been made when the cars were originally designed. If the cars were smaller and if fancy gadgets and trim had been eliminated, the savings in material alone would have been tremendous. For better or for worse, the present designs are apparently here to stay.

The fact that postwar designs did not cut out unnecessary weight and eliminate the gadgets and embellishments is now just another compelling reason why the industry is going to have its hands full trying to get its costs down. And auto executives will tell you they have no intention of sitting idly by watching themselves being priced out of the market.

The auto industry's drive toward lower production costs is expected to grow in scope and intensity during the entire year of 1949.

There are four direct approaches to the car producers' cost problems:

1. More efficient processing, including improved design from a manufacturing standpoint and lower materials handling charges.

2. Lower material costs, including substitutions of materials.

3. Reduced labor costs.

4. Decreased overhead expense.

The automobile industry's investment in production equipment has more than doubled since 1941. Vehicles and parts plants are now using about 400,000 production machines valued at $2½ billion. More than 200,000 pieces of new equipment have been installed since the war.

The new Kettering engine plant recently opened at Lansing is an interesting example. More than 300 machines have already been installed and consideration is being given to doubling the present capacity. One machine, 86 ft long, has more than 90 cutting tools. It handles 17 engine blocks simultaneously, with each block moving automatically through the entire series of operations.

Ford has a 28-station automatic transfer machine[1] built by Kreuger and Snyder that drills 12 oil holes and reams four plug holes in crankshafts.

A comparatively new installation in the industry is a specially designed lathe that finish-machines a rear axle for a passenger car from the rough forging in 32 sec. This machine, designed and built for this job, is equipped with 12 carbide tools.

Special tool holders have been designed to support the round, square and triangular carbide cutting tools. Movement of the tools is hydraulically controlled, and the work is driven from the flange end rather than at the center. Cutting operations on the SAE 4140 steel heat treated to 36 to 41 Rc reach a maximum of 825 sfpm.

Another example of an unusual machine tool is the Gleason Revacycle used for gear cutting. In one plant side gears are being machined from the blank to the finished part at a rate of 77 per hr. The 14-tooth side gear is machined at a rate of 2.9 sec per tooth. Roughing, finishing and chamfering operations are included. The gears are fed by gravity, indexed, and cut by a tool which is, in reality, a circular broach. The finished part kicks off on a waiting rotating spindle. The automatic feed and ejection arrangement makes it possible for the operator to attend several machines.

There is a growing conviction in the automobile industry that most machining operations are too slow. While some resistance has been met in efforts to step up the rate of machining, considerable progress has already been reported.

Based on a searching analysis of its machining operations, one auto plant is approaching the problem from an unusual point of view: The first step taken is to carefully analyze and classify the metallic structures involved—fine pearlite, coarse pearlite, tempered martensite, pearlite and ferrite, etc. As a result of these investigations it was learned, among other things, that the presence of large amounts of free ferrite, carbide or steadite in cast iron, for example, would necessarily slow down machining operations appreciably. Where these microconstituents were not present in appreciable amounts, machining operations could often be speeded up.

[1] *See "Transfer Line Drills Ford Crankshafts,"* THE IRON AGE, *June* 17, 1948, *p.* 72.

The problem is not simple. For instance, in motor blocks the structure will not be entirely uniform. It is therefore required either to anneal specific locations or attempt to produce a balanced structure that offers optimum wear and machining possibilities.

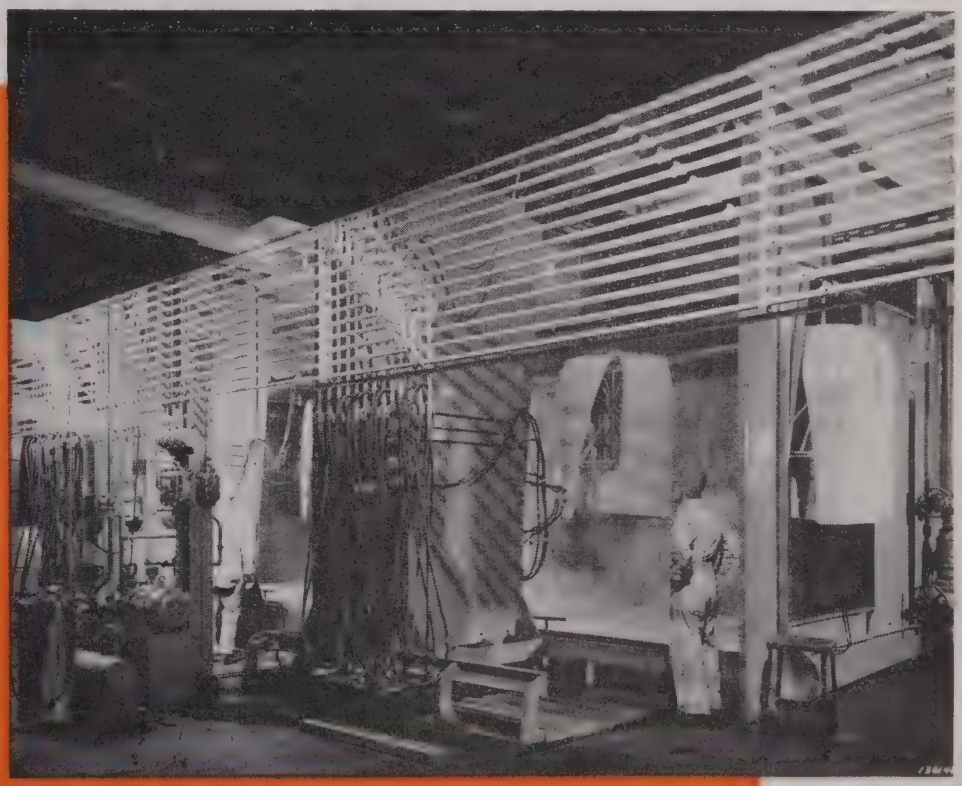
Basically, the aim of the program in this plant is to produce, with necessary strength and toughness, a structure in the foundry or in the heat treatment that permits optimum metal removal or finishing. Once this is established, cutting tools, tool holders and the machine tool itself are designed to accomplish this result. The structure, rather than the part itself, is held to be the controlling factor.

While the present program has been in operation only a brief period, the results have been most promising. In several applications it has been possible to double the previous machining rate and simultaneously get a better finish than was obtained at lower feeds and speeds. It is also believed that substantial savings in tool costs will be realized.

One of the points of interest to the automobile industry at the moment is the best methods of holding tools. The industry is giving careful attention to the design of backing material. More rigidity is desired; also better support for the tools. It has been learned that hydraulic pressures can be of considerable assistance in holding the work. Controls are being carefully studied as a means of preventing uneven tool wear. Interesting new tools are being developed, including carbide drills with high speed centers and central cooling.

There is also a strong movement in the industry in the direction of standardization as a means of reducing machining costs. Some sources feel that spindle nose adapters, for example, could be advantageously standardized. Cutters are not as interchangeable as they might be. Tools, jigs and fixtures could be made more interchangeable as a result of intelligent examination and cooperative effort by the tool manufacturer and the user.

Master mechanics and plant managers continue to look with favor on highly specialized tools where the investment can be justified by increased output or decreased costs or both. A plant manager has estimated that a third of all the equipment in his plant had to be retired because of a recent model change. While far from worn out, the previous machines were so specialized they could not be adapted to the new production and therefore had to be scrapped.



Automatic spray painting is entering the motor car industry. This installation, at the Nash body plant at Kenosha, automatically sprays hoods. Depth of coat is electronically controlled, with the spray gun moving vertically and horizontally to provide the needed coverage.

Thus far, efforts by car manufacturers to reduce material and labor costs have been very limited. Prices of basic material have been climbing steadily. Materials substitutions have usually taken the form of specifying a more expensive material rather than a less expensive one. As a result, manufacturers have been required to concentrate their efforts on improving plant efficiency and reducing overhead costs.

It may be surprising to many readers to learn

the extent of material price advances since 1941: A car manufacturer has compiled the price information given in table I from purchasing department records.

The prices shown in table I are list prices of raw materials. However, in a period of acute shortages, manufacturers generally, and particularly the car builders, have often paid bonuses to obtain adequate quantities of supplies. This applies especially to steel. For example, it has been estimated[2] that during 1948 automobile manufacturers will pay $135 million over the mill price for the steel they use. Most of the additional charge represents the price paid for ingots, having the ingots reduced to slabs or sheet bars, and finally rolled into finished hot or cold rolled products.

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Copper, elect., Valley, $ per lb.	0.12	0.235	+ 96
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Steel, HR carbon bar, 3 in. rd. corner sq., bar AISI C.1125, length 30-35 ft, $ per 100 lb	2.55	4.00	+ 57
Steel Scrap, No. 1 hvy melt Detroit, $ per g.t.	17.85	38.00	+ 113
Tin, Grade A, N. Y., $ per lb	0.52	1.03	+ 98
Zinc, prime West., E. St.L., $ per lb	0.073	0.175	+ 140

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It has been estimated that about one-fifth of all cars and trucks produced during 1948 will be made of premium-priced steel. In addition, approximately 300,000 tons of replacement parts will be made of high-cost steel now being produced in the electric furnaces of carbon and alloy mills as well as several steel foundries which have never before produced steel ingots.

In addition to paying high prices for conversion steel tonnage, the auto industry has made substantial investments in steelmaking facilities. Kaiser-Frazer, it is estimated, has invested several millions in steelmaking or pig iron facilities, in addition to its leased facilities and its Fontana plant. Ford is just completing a steel expansion program costing upwards of $20 million, including its new 1400-ton blast furnace. Both Studebaker and Hudson have purchased small independent steel plants. Several prominent producers are reported to have invested in the new McLouth mill being built at Detroit.

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Because car designs or mill requirements sometimes make it necessary to buy a larger percentage of wide sheets, the cost of auto sheets today has been kicked up another notch. There are also, it is reported, new extras for packaging, stretcher leveling and slitting applicable today that did not apply in 1941.

Since steel costs account for a large proportion of the total raw material cost of an automobile, increases in steel prices have been given widespread attention in Detroit. As the figures in table I show, even after allowance is made for pickling, shearing and extras the rate of increase in the cost of steel is much less than the advance in several other commodities.

A Detroit steel buyer reports that the *delivered price* at Detroit of hot rolled 16 gage sheet bought in Pittsburgh has increased 57.2 pct since 1939. The increase in the delivered price of 16 gage cold rolled sheets out of Pittsburgh is 48 pct. During the same period the delivered price of 16 gage hot rolled strip (one producer excepted) has increased 65.5 pct. The increase in delivered cost of cold rolled 16 gage strip is 41.3 pct.

Meanwhile, hourly labor rates in Detroit have advanced 59 pct as compared with 1941. At the same time car prices have advanced on an average 70 pct. Car profits have, of course, increased simultaneously.

Car producers have sought to justify recent sharp increases in car prices in several ways: They say the increase in the price tags of postwar cars reflects the rise in wages, materials, freight, taxes, machinery and other items. They

also contend it now takes only one-third to one-half as much in farm products to buy a new car as it did to buy the same car before the war. Table II shows comparative car prices, related to wages of U. S. factory employees. A car manufacturer has argued that, even at today's high prices, 25 pct more families can afford to buy a car now than could afford one before the war.

The second argument offered to justify the higher prices of automobiles is the substantial gain in weight, power, car life, performance and standard equipment available in today's motor cars.

For example, one large car producer listed in 1948 more than 50 items of standard equipment that were either unknown in 1925 or were being sold as extra-cost accessories at that time.

According to AMA, in 1925 the typical low-priced car had a 20 hp engine, weighed 1500 lb and was 11 ft long. In 1948 the same make of car had a 100 hp engine, weighed 3200 lb and was over 16 ft long.

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Steel extras have all been carefully tabulated and evaluated. As soon as steel becomes plentiful again, many plants are going to change from steels carrying large numbers of extras.

The interchangeability of alloy steels having comparable hardenability is now accepted throughout the industry. Steel specifications are much more flexible than they were during the prewar period.

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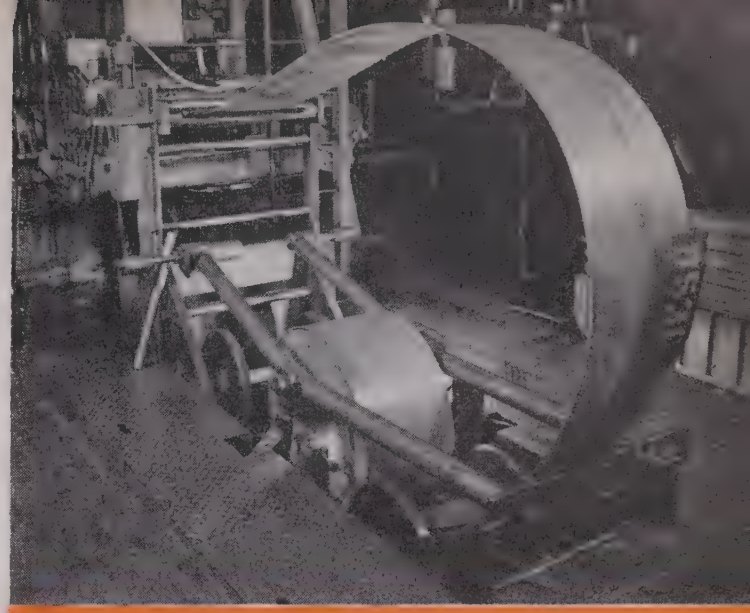

Progressive dies in which coiled steel is fed continuously into a press are an excellent example of the automobile industry's mass production methods. Shown here is a 1400-ton press at Chevrolet-Detroit Gear and Axle Div. Stock is 0.125 in. thick and 21¼ in. wide. Coil weight is 15,000 lb. The coil is unrolled from below and the loop is controlled by a limit switch.

Another interesting development is the use of closely controlled carburization and diffusion. A division of General Motors is forming low carbon steel (under 0.10 pct C) into a clutch spring. The part is carburized after which the supply of carbon is cut off. The carbon is then diffused throughout the piece. The heat treatment cycle takes about 8 to 10 hr after which a heat-treatable part with 0.40 to 0.50 pct C is available. The parts previously presented some difficulty during the forming operation; later the supply of SAE 1065 was cut off, and a satisfactory substitute had to be found.

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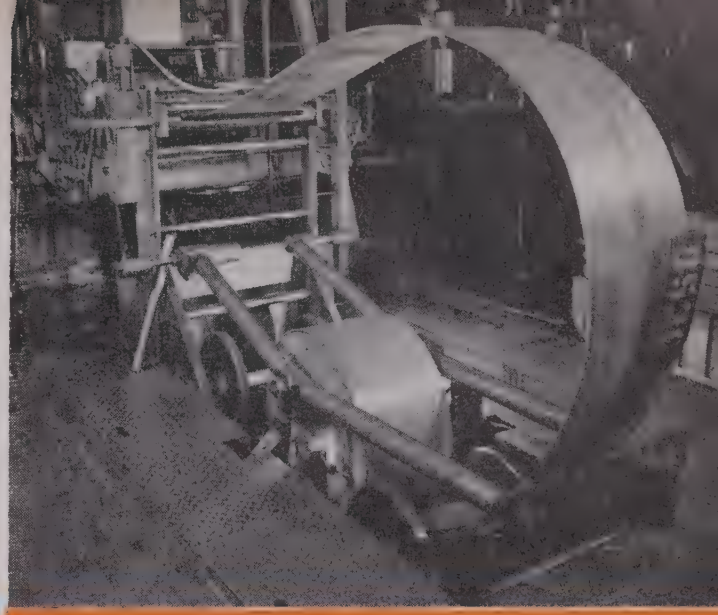

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tempering has been used effectively in some heat treatment operations where no other method would serve.

Changes in labor rates are of vital concern to the motor industry for several reasons. Wage boosts add directly to production costs in the auto plants. In the past, increases in costs passed on by suppliers have been as great, if not greater, than the increases granted to labor. Sooner or later, the same wage increases filter down to transportation and raw materials.

With a fourth round of wages almost a certainty, it is quite certain that car prices will be boosted again in the not too distant future.

Meanwhile, the strong opposition by the UAW-CIO to wage incentive plans continues. At the present time, piece work or other forms of incentive pay have all but disappeared from the major auto plants. While a substantial number of parts producers have managed to retain incentive pay scales, others have bargained such plans away in negotiations with the union.

Labor Productivity Low

Auto plant executives still contend that labor productivity is low compared with prewar standards. Nevertheless, upward changes in production rates have been vigorously contested in many plants and this opposition by union leaders is expected to grow if the market for new cars shows any symptoms of softness.

In addition to the use of machine tools and presses that operate faster and more accurately, the industry is making strong efforts to reduce the amount of energy that goes into a job. Few workers have to lift heavy objects in an auto plant today. The position of materials coming to the machine, the position of the worker at the machine handling the part and removing it from the press are being carefully studied. The name given this activity—which is going on in all plants—is Methods Engineering or Process Engineering. As opposed to the older time study, the new approach is to standardize the operation rather than merely to establish time limits. It is now recognized that neither the consulting engineer or the foreman is in the most advantageous position to handle this job which must be a day-to-day, organized effort throughout the plant. There must be, it is argued, full cooperation between the part designer, the tool designer and the manufacturing department.

A question that is being asked frequently in Detroit nowadays is, "What will this operation do to the man?" Experience has shown that if the operator is favorably affected, production rates can be set much higher than would otherwise be the case.

Another way to save labor in an auto plant is to cut scrap losses. Auto dies are much more fool-proof today than they were a few years ago. As one plant manager observed, "Our parts are either all good today or they're all bad. We try to design our dies that way."

With greater reliability built into its dies, the industry has been able to reduce inspection costs substantially. One auto plant is producing 12,000 wheels a day but uses only two inspectors. A few years ago, several times this many inspectors would have been employed.

The increased use of quality control methods is also expected to result in substantial savings in both material and labor costs.

Plant managers in Detroit have learned that the use of a scrap tunnel under the press room may result in substantial savings in materials handling. Feeding of stock to the operator by gravity also helps to cut costs. Mechanical pickups from presses have been widely adopted. Much consideration has been given to setting conveyers at just the right speed—neither too fast nor too slow—as a means of improving labor efficiency.

Auto plant executives are incessantly whittling away at their labor costs. But they are obviously conscious that a spirit of willingness on the part of the operator will probably accomplish more than all the steps they can take in redesigning parts and installing improved tooling or better materials handling. The human element is still the most important factor in the auto plants, despite the high degree of mechanization.

Freedom of action in specifying materials is naturally restricted during a period in which the demand for materials far exceeds the available supply.

Except for greater interchangeability of steels, specifications have not changed much. An exception is bumpers where the new large bumpers and extreme designs have presented forming and metal finishing problems. One result has been a change to low carbon, low alloy, high tensile steel from high carbon spring steel. This low carbon material can be cold formed and there is a considerable saving in the cost of metal finishing. Martempered SAE 1045 is also specified. Chevrolet, with its simple design, plans to stick to spring steel bumpers and is a notable exception to this trend. The selection of 3-piece or 1-piece bumpers is a matter of design and the manufacturer's choice. Bumper mountings, made of spring steel, are getting heavier.

First Costs Favor Diecastings

Stainless steel and die castings are being used interchangeably for front grilles. First costs are said to favor diecastings, particularly for complicated grilles. However, since diecast grilles cannot be repaired and must always be replaced, the car owner may prefer stainless. Low carbon plated steel is also used for grilles.

Several car producers have given up plastic instrument panels in favor of steel which is formed *after* the finish has been added. An exception is Nash which has developed a clad-type plastic panel consisting of a polystyrene base which is sprayed with a 0.002 to 0.003 in. layer of methyl methacrylate type material. The latter is a fairly expensive plastic which has highly desirable characteristics including abrasion resistance and good cold flow characteristics; it is non-warping and non-aging and is impervious to cleaners having high hydrocarbon content.

What to Look for in the 1949 Cars

1. Some bumpers of intricate design are now made of 0.08 to 0.10 C, cold formed high tensile low alloy steel—not spring steel . . . Expensive finish on some steels is protected during press work by spraying with plastic, later peeled off.

2. Both stainless and diecast grilles are being specified, but automobile insurance companies prefer stainless.

3. Fully automatic torque converter type transmissions are coming fast. Chevrolet, Packard and probably others will follow Buick in 1949.

4. One manufacturer is planning to eliminate most of the rivets in a new all-welded frame.

5. Nash is using a "clad" all plastic instrument panel; most other manufacturers use steel . . . Stylists are working overtime on new instrument panels and interior trim.

6. Curved glass windshields will be de rigueur for future cars despite cost of about 50 pct more than flat glass.

7. Bonded brake linings are replacing riveted linings on several passenger cars.

8. Tops, including windshied and rear window openings, are now stamped out as one piece.

9. Most coil springs are shot peened or grit blasted to improve resistance to fatigue. New type shot is expected to improve control and reduce costs.

10. New carbide-tooled machines are sending feed and speed rates to new highs . . . Rear axles are being turned from the rough forging to finish-machined part in 32 sec.

11. Working together, styling, engineering and manufacturing divisions of one company found 60 improvements in a single part design before going into mass production. The industry will see much more of this kind of cooperation. Air ride low pressure tires require many changes in front suspensions. One producer has eliminated 19 lb in the process of redesigning the front axle.

12. Compression rates are going up. Cadillac is tops with 7.5 to 1 ratio. High compression has the spotlight because of greater fuel economy; actually, the new V-type engines cost more to build. Material shortages have created many foundry problems. Several producers have found it necessary to pickle blocks prior to machining.

13. Kaiser-Frazer eliminated 52 parts in redesigning its clutch mechanism. Selective hardening of steel parts using controlled gas heating is getting increased attention.*

14. Off-the-highway users want more road clearance.

15. To provide additional leg room, floor pans have been redesigned.

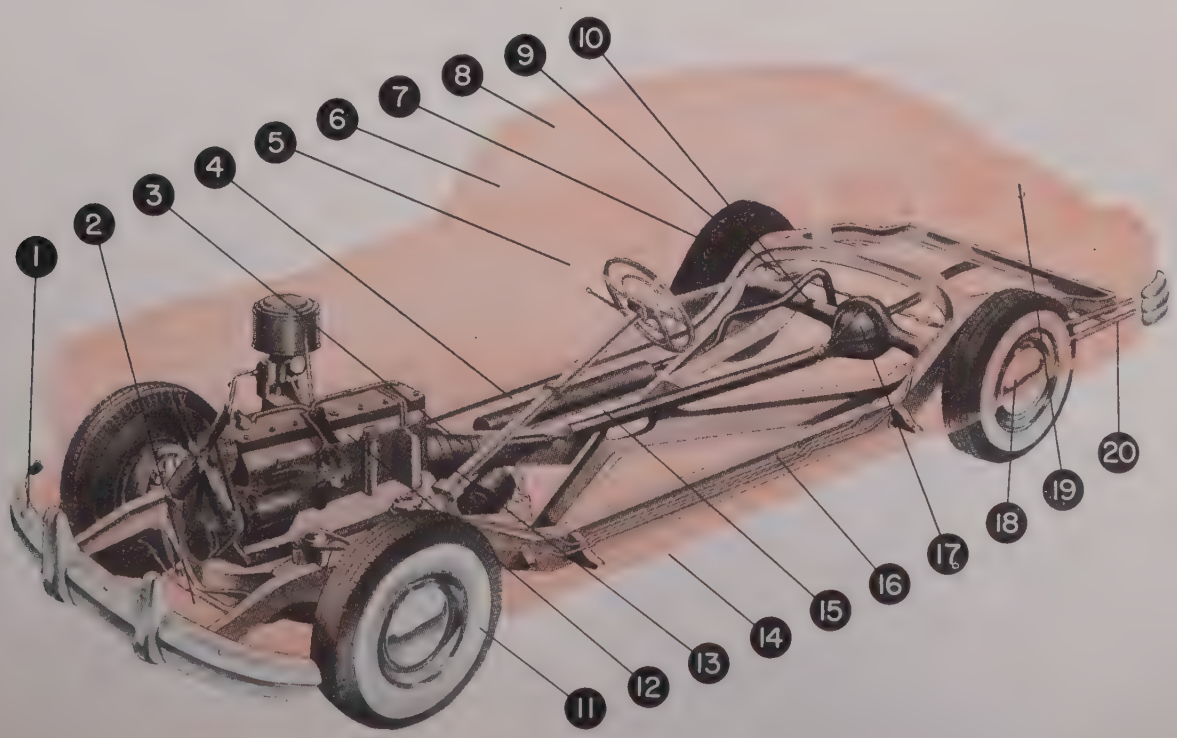
16. Several new cars provide more leg room in a shorter chassis.

17. Interchangeability of alloy steels having equivalent hardenability is now broadly accepted.

18. Stampings are larger in the new cars and less solder is being used.

19. Rear engine drive has been relegated to the background for the time being.

20. Chrome strike over stainless trim is used to match other chromium plating. Anti-corrosion benefits of the chrome strike are being investigated.



The process is patented by Nash and has the trade name, "Logoquant." Cost is about half that of methyl methacrylate plastic, it is reported.

Substitution of aluminum for steel in automobiles has not come up to earlier expectations. For one thing, aluminum has not always been available. In some instances, costly die changes were required. Strength may not have been adequate. There have also been welding problems and corrosion problems.

In refrigerator manufacture, however, there have been liberal substitutions of aluminum for steel. Most producers are now using plastic inside trim in place of stainless. Evaporator trays, crispers, defroster trays and even meat trays are being made of plastic rather than metal or glass. Some home freezers and beverage tanks are lined with aluminum instead of steel. Aluminum tubing is being substituted for steel. While presenting some joining problems, aluminum has been widely accepted as a satisfactory substitute for steel by the refrigerator industry.

Better methods of handling material mechanically and scientific packaging of materials offer one of the best hopes the auto industry has for cutting costs, it is admitted. Much emphasis is going to be placed on material packaging and handling during the next few years. A truck maker reports estimated savings of $38,000 in crating costs on a shipment of 27,000 engines on special pallets.

Purchase of banded lots of 1x6 in. boards instead of loose boards saves an estimated $84 per car in unloading costs.

Another company formerly used separate cases for each of 82 kinds of radiator cores. A change was made to cartons, with special fillers. Estimated container savings is $20,000 a year. Damage costs, it is reported, dropped sharply and freight charges were reduced because the new case weighed only 8 lb compared with the previous 80 lb.

Stock fed into the progressive die setup on this 900-ton press is so controlled that it moves forward (to the left) through one station with each lift of the upper die. Visible at the extreme left is the mechanical "shovel" which moves in to receive the finished part and carries it out, dumping it into a waiting bin.

One car producer estimated 70 pct of its material is palletized today compared with only 5 pct before the war.

An auto executive has estimated that 80 pct of the operations in his plant involves material handling. In this plant, special emphasis is being placed on package design and the use of expendable pallets.

Although made entirely of paper, the new pallets are being employed to package speedometers, batteries, brake assemblies, pistons, radiator cores, mufflers, bearings and similar items. Where convenient, the cardboard packages are stacked adjacent to the assembly line where they function as storage containers.

Materials packaged in these expendable pallets can be loaded quickly on trailer trains for economical transport to all plant areas.

While it has been estimated that in the U. S. in 1946 80 pct of all material handling was done without the aid of mechanical equipment, the use of such equipment by the motor industry is certainly greater than this today. Most observers here see a pronounced trend in this direction if the industry is to keep up its policy of exploiting every opportunity to reduce production costs.

Foundry Cost Reductions

In recent years Detroit foundry managers have given much attention to improvement of working conditions and re-engineering and redesigning their equipment. During the past year, however, more attention has been given to foundry processing.

As a result of some technical developments which have not yet been publicly divulged some Detroit sources are predicting unusually rapid advances in foundry practice will be made during the next few years.

Automotive engineers are insisting that something be done to reduce the cost of gray iron castings which has been climbing steadily since car production was resumed following the war.

Recent experiments with synthetic core binders have shown considerable promise and this work is expected to go forward. A considerable amount of research has been devoted to mechanical problems in the foundry—problems of design and drying of cores, methods of supporting cores, etc. Molding practices have been critically examined and recent experimental work has indicated it is now possible to pour complicated gray iron castings having sections as thin as 1/16 in. using sand molding.

Utilizing the latest foundry techniques a producer of automatic transmissions has been able to sand cast several critical parts which had previously been cast only in plaster molds.

Another interesting development is cast-to-shape dies for plastics and rubber, for example, which do not require expensive Kellering operations. Cost is said to be only 30 pct of the cost of steel dies for the same application.

The automotive industry is watching carefully the current developments in nodular cast iron.

As the year 1948 came to a close there were

indications that the pinch in raw materials which has plagued Detroit's foundry industry since the end of the war might be somewhat alleviated. If true, this would be good news to founders who have been serving their automotive customers for many months under the most adverse conditions in the history of the industry.

Welding Purchases Set Record

Investments by automobile companies since the war in new high speed welding equipment have exceeded any previous purchases in the history of the industry.

The trend is strongly toward the use of multiple transformers with as many as 130 welding guns discharging during a few brief seconds. Because control is less critical than in some other types of machines, three-phase dry disk rectifier type welders have been favored by several car companies.

Instead of the earlier practice of moving weldable parts from one press to another, welding operations are now set up wherever possible in a straight line with the parts moving progressively through the machines directly from the presses to the final assembly. Use of the 4-column hydraulic welding press is now common practice throughout the industry. In the event of a model change the welding frame remains and the welding guns are reset as a unit, upper and lower, to accommodate the new design.

Welding engineers in the automobile industry have gone all out for electronic controls. There have also been important advances in the use of submerged automatic arcwelding. This method is now successfully employed for heavy sections such as rear axle housings, frames, clutch pedals and brake pedals. Using the latest type equipment, production rates have been reached that were heretofore considered impossible.

Automatic bare arc is also used for a limited number of applications. An interesting use of a stud welder is to attach studs which hold bumper guards in place.

Looking Forward in Detroit

As its critics have often pointed out, the automobile industry is never satisfied with anything. It is always experimenting and tinkering and looking for new ways and means to do something faster and better and cheaper.

The motor car builder has always prided himself in the fact that he gives the customer more for his money than any other industry. Because it has followed this philosophy, say Detroit executives, the automobile industry has constantly broadened its horizons while many other industries have stood relatively still or faded from the competitive scene. The industry does not say this boastfully—it is simply the creed Detroit has always followed and intends to keep on following.

To implement such a policy requires constant inquiry into materials and processing. Often these inquiries bring forth a request for new materials or equipment, some of which may not even be available.

The industry would like to use more automatic paint spraying. In some Fisher plants, tops are sprayed automatically. Nash is spraying hoods with automatic equipment at Kenosha, Studebaker has recently been using electrostatic spraying of fenders and hoods at South Bend. The industry sees many logical applications for automatic paint spraying equipment.

Use of expendable paper pallets for handling coil springs, as illustrated here, is typical of the emphasis being placed on the use of modern material handling techniques. These paper pallets, as used by Kaiser-Frazer, will support surprisingly heavy loads, despite their light weight.

Auto plants are fast getting rid of "tack spitters" but improvements in trim and seat operations can hardly come fast enough to please a lot of plant managers.

Kirksite zinc alloy dies are being used extensively by General Motors Overseas in building cars outside the United States. In several GM overseas plants, 3-piece zinc alloy dies are used on regular presses. No machining is required where patterns are accurate. In some instances dies have been put in operation less than 24 hr after patterns are made available. Production of 20,000 parts from a single die under favorable conditions is not uncommon. The industry would welcome a new die material with the properties of Kirksite but which gives longer die life. There are some indications that such a material may be developed.

Auto plants are not using much aluminum, but where welding is employed points have had to be constantly maintained at great expense. The industry could use more satisfactory points for welding aluminum.

As was noted earlier, the auto industry is fighting high production costs in any form in which they now appear. The years immediately ahead are almost certain to see the most sweeping changes in processing in the history of the industry. And, if the raw material supply situation permits a wide range of choices, an equal number of changes of material specifications can be looked for. All these changes will add up to a very necessary quotient—drastically reduced production costs.

western steel

Despite a 300 pct. increase in steel-making capacity over the past 9 years, the West Coast remains a steel-short area. The balance sheet of this fast growing section is studied in this first-hand report of the western steel industry. The author also presents an authoritative breakdown, by product, of the area's estimated 1949 record breaking steel production.

By R. T. REINHARDT
West Coast Regional Editor,
THE IRON AGE

Markets are people—and the tremendous movement into the seven western states since 1940, which has increased this area's population by 41 pct, has also created an apparently insatiable demand for the myriad of material things human beings need.

Responsible experts both in government and industry predict this westward migration will continue perhaps for as long as 12 years without appreciable slackening in rate and that business and industry must prepare to supply this growing market and provide employment for this flood of workers.

It is apparent that the western steel industry is alive and sensitive to its responsibilities if the expansions made since 1940 and those now underway are properly appraised. Approximately $300 million have been invested during the past 8 years, and about $50 million more will go into furnaces and mills within the next 2 years.

Increases in capacity put into operation, to produce everything from iron to finished sheets, exceed any forecast made before the war. At that time one lone 600-ton blast furnace was casting pigs in Provo, Utah. Today that stack has another 600-ton and three 1200-ton furnaces for company; and in southern California another 1200-ton stack is reducing California ore. Together these furnaces produce almost 2 million tons of iron per year. Last month ground was broken at Fontana, Calif., for still another 1200-ton stack, which is scheduled for production in about a year.

All the openhearth and electric furnaces in the West in the prewar era yielded less than a million tons of steel. In 1949 something like 4,074,000 tons of steel will go into ingots. "Rated annual capacity" for this same area in 1948 was 3,923,500 tons.

Less than 750,000 tons annually of rolled products came off western mills before 1940. In 1949 there will be 3,015,000 tons of finished steel available to industry from mills in the seven western states, a 300 pct increase in 9 years.

Production inceases forecast for 1949 over 1948 are encouraging. Fur-

naces in the seven western states will probably pour at least 300,000 tons more steel than in 1948 because of added facilities to come into service and improved operating methods. Additional tonnage for rolling in this area will accrue because use for castings, forgings and shipments out of the territory will be reduced. Anticipated finished steel production for 1949 shows even greater improvement, with best estimates placing this figure at 450,000 tons higher than in 1948.

These figures have been arrived at on a realistic basis in which idealism, wishful thinking and "blue sky" projects have been brushed aside. While rated capacities are significant, such figures are meaningless unless all factors are taken into consideration. From reliable sources among principal producers in the seven western states THE IRON AGE received confidential information which was carefully analyzed and weighted by known factors of expansions, operating efficiencies, power limitations, raw material availability, and were discounted for over-optimism to arrive at the figures above and those in table I.

On this basis, steel users may expect to obtain, from combined production in the seven western states during 1949, the tonnages shown in table I.

These data represent scheduled production figures subject to change as market conditions fluctuate, but at the moment they represent the most authentic breakdown available. Greater detail would be desirable for the benefit of steel users, and the happy day may come when producers will be willing to give more complete breakdowns for reports such as this.

It will be readily apparent that there is considerable discrepancy between the forecast ingot production and projected finished steel yield of western producers. There has always been ingot capacity in the West used for production of steel for purposes other than rolling. For 1949 it appears that of the approximately 4,074,000 tons of steel to be produced here, 250,000 tons will be shipped out of this territory, or used here for the production of castings and forgings. The remaining production of 3,824,000 tons will yield the 3,015,000 tons of rolled products tabulated in table I.

While this tonnage of rolled products does not set even a square meal for steel-hungry users in this area, it represents a feast by comparison with the volume of rolled products made here before the war.

These are the principal factors contributing to the anticipated increase in ingot production in the West in 1949:

Kaiser Co., Inc., poured the first heat from its 185-ton openhearth late last month, which is expected to produce about 150,000 tons per year.

Pacific States Steel Corp. at Niles, Calif., will get the first of its four second-hand, 60-ton openhearths, rebuilt to rate at 150 tons each, into operation in August and will produce about 37,000 additional tons in that furnace in 1949.

Oregon Steel Mills at Portland, Ore., will get its recently acquired additional 6-ton electric furnace going in February or March.

Southwest Steel Rolling Mills in Los Angeles expects to get into production in March with its 10-ton electric furnace.

TABLE I

1949 Finished Steel Production of Mills Located in the Seven Western States, in Net Tons (Estimated by THE IRON AGE).

Plates	925,000
Sheet and Strip	303,000
Tinplate	200,000
Butt Welded Pipe	91,000
Standard Structural Shapes	501,000
Hot Rolled Bars and Small Shapes	772,000
Wire Rods and Wire Products	205,000
Miscellaneous	18,000
Total Rolled Products	3,015,000

Rainier Steel Corp., Tacoma, late last year started operation of a 6-ton electric furnace.

Bethlehem Pacific Coast Steel Corp. expects to increase production through improved furnace operations.

Century Steel Co., recently organized in Los Angeles, may get into production with a 6- to 10-ton electric furnace before the year is out.

All of these additions except the last have been taken into account in computing ingot and rolled tonnage yields for 1949.

Included in the estimates of rolled products available during this year, of course, are those coming from the Pittsburg cold rolled sheet and tinplate mill of Columbia Steel Co. and from increased facilities at smaller plants. Production of the announced 86-in. mill of Kaiser at Fontana has not been included, since this facility probably will not be in operation until the end of this year or early 1950.

Total hot metal tonnages of principal steel producers expected to go into forgings or castings or be shipped out of this area include those of Isaacson Iron Works, Seattle, 60,000 tons; National Supply Co., Torrance, 46,000; Pacific States Steel Corp., Niles, Calif., 74,000 (partial production); Rainier Steel Corp., Tacoma, 30,000; and Pacific Car & Foundry Co., Seattle, 40,000.

It is unnecessary to labor the point that the present supply of all finished steel products is far from adequate to meet the actual western market, let alone the phantom-like factor called "demand." The best available estimates on the current market for finished steel products in this area is approximately 4½ million tons, but without taking product mix into consideration this figure is inconclusive. In discussing future long-range markets such as may exist in 1960, some top-flight steel executives in this territory have come up with estimates which in the aggregate indicate an actual market potential of between 5 and 6 million tons, but a total near the lower figure appears to be most realistic. Assuming that that is a rough approximation, the question arises as to how far the West can go toward supplying anything like that in the way of finished products. It is generally conceded—but not unanimously so—that the limiting factor on steel production in this seven western states area will be availability of raw material, with particular emphasis on scrap.

Historically rich in scrap, the West Coast at present is scraping the bottom of the bin, and there are few competent men in the field today who will venture an opinion that the situation will ever improve greatly. Thus it is apparent that steel production will be limited over the long pull at some place close to its present figure. Possibly it may be increased as much as a million tons in the next 12 years if the scrap cycle is speeded up and some of the more than 100 iron deposits in this region are developed for blast furnace operations. The consensus of top executives is that the major developments in western steel will occur through diversification and improvement of present finishing facilities, although it is certain that at least a few additional electric furnaces will be installed and one major producer has done some preliminary work on the foundation for an additional large open-hearth.

The trend is already apparent in the plans of Columbia Steel Co., Bethlehem Pacific Coast Steel and Kaiser, all of which have already made such expansions or have announced them.

One of the newest of the many weird and sometimes incomprehensible elements steel market analysts must weigh in making predictions and production recommendations is that labelled "effect of the f.o.b. mill price system." These slide rule experts are unafraid to juggle population growths, plant expansions, laws of supply and demand and such other factors as recessions and booms. But with both steel producers and steel buyers uncertain at the present time of the overall effect of this change in pricing methods, and consequent alterations in buying habits and trends, the experts find it a disturbing element which refuses to alloy with other factors.

For the present at least, prognosticators of demand for 1949 are tentatively accepting the f.o.b. price system as the one which will govern buying and selling. Consequently some shifts in product mix and market participation have had to be made.

While present heavy steel demand tends to shroud the shores of the islands of trade for each of the western producers, and becloud efforts to predict those limitations in what lightheartedly is called a "normal" market, there is enough evidence at hand to give an approximate idea of how the principal producers will fare under the changed pricing system. Ignoring the current and temporary willingness of a prospective steel user to get his material wherever he can find it and at almost any cost, and thinking toward the day when cost of steel in the user's shop will once again be an important factor, limitations of market territories are not too difficult to discern.

Bethlehem Pacific Coast Steel Corp. can reach the San Francisco market at lowest cost to the consumer on those products manufactured at its South San Francisco plant, and that Columbia at Pittsburg, and Pacific States Steel Corp. at Niles are in second most favorable position. Only in a few instances, however, are products of these three companies directly competitive. Neither Bethlehem Pacific nor Pacific States produces sheet, and consequently this gives Columbia sheets a marked advantage in the San Francisco market which it can reach for $1.60 per ton.

Kaiser will be producing up to 86-in. hot rolled sheets within the next 2 years and conceivably might invade the San Francisco market, although its customers would be discouraged by a $6.20 per ton delivery charge from Fontana.

For the immediate future it is apparent that Bethlehem shipping out of Sparrows Point and delivering to San Francisco at a cost of approximately $17.46 per ton affords the only real competition for Columbia. Pricewise, Bethlehem, f.o.b. Sparrows Point, should be able to get well below Columbia because it can spread amortization and depreciation costs of a modern mill over a larger tonnage than can Columbia, which must also include in its production costs freight of $8.18 per net ton from Geneva for the hot rolled coils it needs now at Pittsburg, and in 2 years at Los Angeles, to produce its cold rolled sheets.

Sheet Market Competition

In southern California it is apparent that Columbia at Torrance is in the most favored position at the present time to control the sheet market. At the end of 2 years, when its new cold strip mill will be in operation in Los Angeles, this company should dominate that market, with its closest competition coming from Kaiser at Fontana. Columbia will be producing approximately 325,000 tons of cold rolled sheets per year when its new mill is completed about 1951, and Kaiser will probably be producing 100,000 to 200,000 tons of hot rolled strip annually within a year with which to supply that area.

Sheets delivered in Los Angeles from Sparrows Point would carry a freight rate of approximately $18.38 per ton, which would be a burden in a competitive market. However, with the Pittsburg plant of Columbia paying $8.18 per net ton freight on Geneva's coils, and the announced mill for Los Angeles paying that much or more freight, this disadvantage to Bethlehem is reduced to about $10.20 per ton.

Bethlehem shipping sheets from Sparrows Point to the Pacific Northwest would fare considerably better there, and probable cost of Bethlehem sheets to the consumer would be the lowest of any supplier since the rail freight from Pittsburg, Calif., to Portland is $10.60 per ton and to Seattle $12.00 per ton; and from Torrance or Los Angeles to Portland, $16.40 per ton, and to Seattle, $17.80 per ton; whereas Bethlehem can lay sheets down at both of those points for approximately $16.95 per ton freight; and assuming Columbia had to include in its price the $8.18 per net ton freight on coils from Geneva.

It is interesting to observe that in the Spokane market, which many believe will be an increasingly important market for reinforcing bars and structurals because of proposed government projects, Geneva Steel Co. has a marked advantage in being able to ship from Geneva, Utah, to Spokane at a rate of $11.60 per ton, and that the next lowest freight rates of producers of reinforcing bars and small shapes in this area are Oregon Steel Mills at Portland and Northwest Steel Rolling Mills at Seattle, whose products carry a $13.40 freight cost.

Steel

The new sheet and tin plate mill of Columbia Steel Co. at Pittsburg, Calif.

Geneva Steel Co.'s Provo, Utah, plant. The openhearth department can be seen in the immediate foreground.

Electric furnace and rolling mill buildings of Pacific States Steel Co., Niles, Calif. Foundations for four new openhearths are visible at lower left.

Fontana, Calif., plant of Kaiser Co., Inc., only fully integrated steel plant on Pacific Coast. A pipe mill has been recently added to the plant.

for The West

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Air views of the fast expanding Western steel industry. Shown here are some of the major plants of the area; plans are underway for further enlargement of some of these units.

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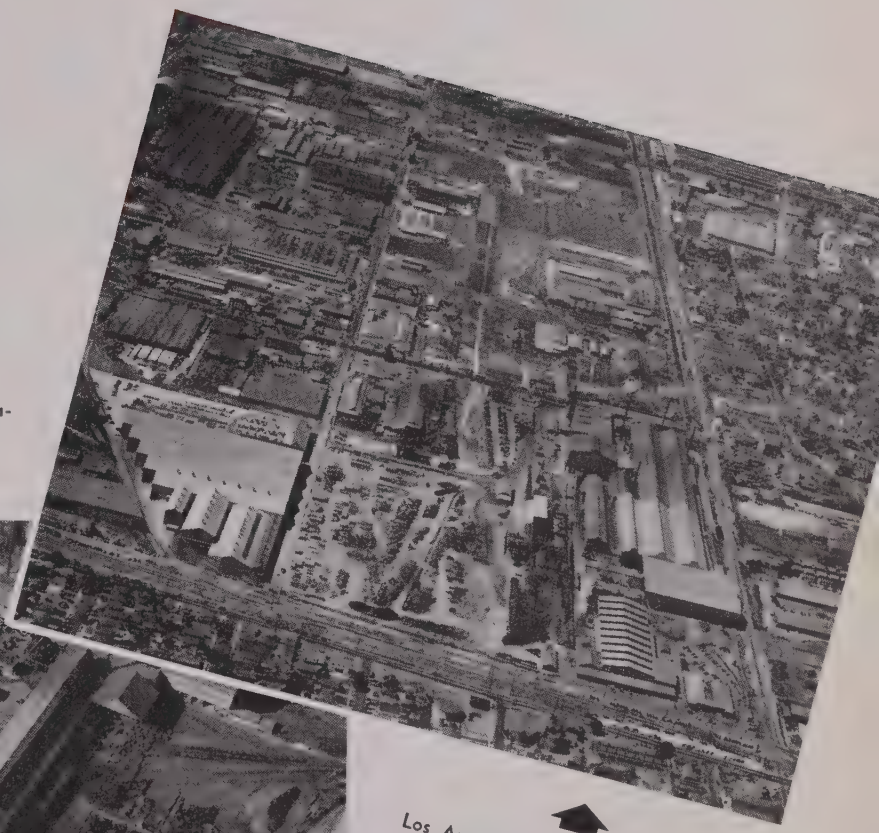
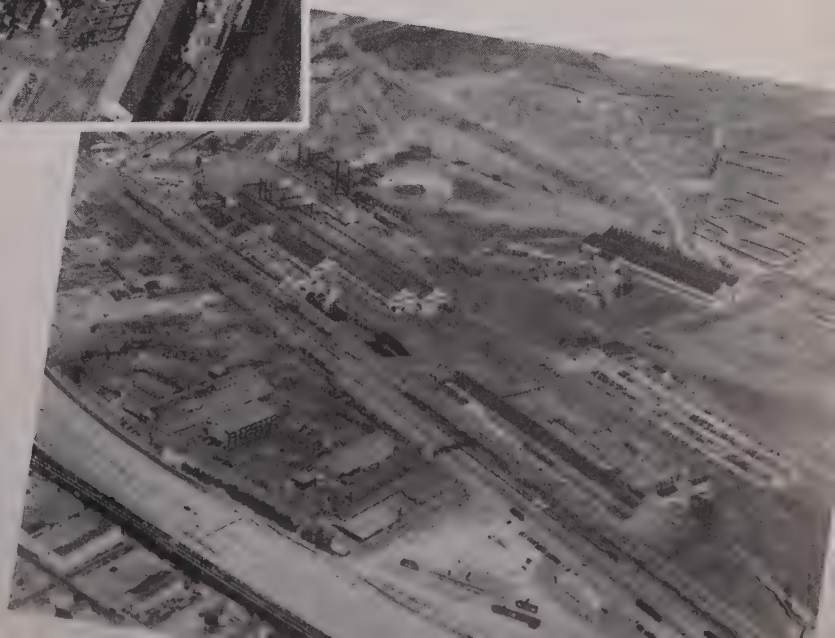
View of the Seattle plant of Bethlehem Pacific Coast Steel Corp.



Los Angeles plant of Bethlehem Pacific Coast Steel Corp.



South San Francisco plant of Bethlehem Pacific Coast Steel Corp. Bolt and nut plant is at the upper right.

Coastwise Shipping Limited

Note that shipments from Duluth and Chicago can move into Spokane at rates comparable with those from Torrance, Fontana, Pittsburg and South San Francisco.

This matter of market penetration and freight limitations may be changed somewhat in the event coastwise water shipping is resumed. At one time this was an important factor, but with the temporary abandonment of this service on the basis of lack of profit, railroads and trucks have taken over completely. Intercoastal deliveries made in their own bottoms by subsidiaries of U. S. Steel Corp. and Bethlehem Steel Co. of course continue.

Kaiser is in the second best position freightwise in the southern California market. This fact is small consolation to customers who feel there is little chance of this proving of benefit until there has been some adjustment of the company's RFC loan or until that loan is substantially reduced through profits produced by the $30 per ton increase in the price of steel put into effect in August of last year, or competition brings price reductions.

With both rail and water shipping costs for each producer remaining in the same ratio as they are today, and probably continuing to be in the foreseeable future, Kaiser will not be able to reach even so far north as San Francisco competitively with sheets, and Columbia's Pittsburg production will not be able to compete in the Pacific Northwest.

If this analysis is correct, it would indicate that in a so-called "normal" market of 600,000 to 700,000 tons of sheets both Kaiser and Columbia could dispose of their total sheet output in their respective territories without serious difficulty. This would mean that Bethlehem could participate in this western sheet market to the extent of approximately 100,000 tons. These calculations eliminate any other source of supply on the assumption that high freight rates from inland producers would make them non-competitive with the three companies discussed, and only in a sellers' market could they hope to unload appreciable quantities of common grades of sheets in this area. Special analysis sheets will still be provided by some of the inland companies, but tonnages involved are not considered appreciable except in those instances where materials are being provided to captive subsidiaries which use common grades of steel sheet.

These estimates of company participation in the sheet market are based on the assumption that Columbia's Pittsburg cold rolling facilities will turn out approximately 100,000 tons of sheets; that Kaiser will make about 100,000 tons of hot rolled sheet for sale on the new Fontana 86-in. mill, and about 100,000 tons for sale on the existing 18-in. skelp mill; and that Columbia will make about 300,000 tons on its old mills at Torrance, and the new mill announced for Los Angeles.

Any variation in this product mix by either of these companies will, of course, affect participation by competition. Some observers believe that with tinplate demand continuing to increase (1948 use in this area reportedly reached 700,000 tons) and with the San Francisco Bay Area alone already clamoring for 350,000 tons per year, Columbia may find it more desirable to devote practically its entire Pittsburg output to that product. If that trend materializes, it will open up substantial markets for additional Bethlehem sheet tonnage.

In discussing the f.o.b. pricing system with top executives of western steel producers it is evident that there still remains considerable confusion as to whether the new price system is a benefit to each of the West Coast operators or is a threat to future marketing programs and to established and announced expansions.

Henry J. Kaiser told THE IRON AGE that in his opinion the establishment of the f.o.b. system should be of benefit to Fontana because of its proximity to a large market for most of its tonnage. H. H. Fuller, president of Bethlehem Pacific Coast Steel Corp., believes that his company will suffer no serious loss in business; but spokesmen for Columbia Steel Co. were less sure of the overall effect on its western operations. This company already finds it difficult to compete on wire products and sheets in the Los Angeles territory and their northwest market for reinforcing bars has been seriously impaired.

It is apparent that if Congress makes it clear that the f.o.b. system is here to stay, there will be a trend toward locating steel users' plants as near to existing steel producers as marketing of finished products warrants, and any new producing facilities will be influenced to move as close to large markets as availability of raw materials will permit. Here in the West, where steel is largely produced from scrap, such a course is practicable because large marketing areas are good scrap producers. It is possible that increased production capacity here may be in the shape of a number of small electric furnace operations in the principal coastal cities.

To arrive at any definition of market territories in the future, it is necessary to discount the present almost hysterical demand for steel, anticipate a "normal" demand, and then apply the freight factor. Since all of these elements are imponderables for the future, it takes a skilled analyst with a crystal ball to arrive at anything like a true market study.

In probing for the basic thinking concerning future facilities for the West being done by some of the best brains in the steel-producing industry, it was found that opinions varied greatly.

Among the big wheels of western steel production, Henry J. Kaiser, of course, is the outstanding proponent of ever-increasing production and literally exudes enthusiasm and optimism in discussing the growth of the West and the fact that "human needs are limitless." Mr. Kaiser refuses to admit that another major depression or a recession is inevitable, but he declares "we can make a man-made depression if a fear-psychology is permitted to prevail."

Kaiser Invests $130 Million

It cannot be denied that Mr. Kaiser has backed up his philosophy of optimism with dollars—and it should be pointed out that these are not all government dollars—and has staked a considerable part of his fortune on the continued growth of the West and its prosperity. Eliminating his ventures in aluminum, automobiles and cement

and all of the 26 projects other than steel in which he has a hand, Kaiser-controlled investments in steel in the West total $130 million. It is true that the Fontana steel plant is heavily in debt, but it is equally true that this debt is being paid off fully and on schedule, and unbiased competent observers believe it will be brought down to a reasonable point before it is necessary for him to reduce his steel prices to meet competition.

Mr. Kaiser's advocacy of the plan to permit 5 year amortization of new investments in steel production is well-known, and he apparently is sincere in his belief that such a program would bring about increased production and alleviate present shortages which he sees continuing into the future indefinitely.

When it was pointed out to him that if such an amortization program were adopted, it would in all likelihood stimulate numerous small independent steel producers in the West who would be in direct competition with his Fontana mill, he said, "We invite competition; it has caused our high standard of living." When asked if he personally would take advantage of such a program, he said, "We most certainly would and quite possibly would triple production at Fontana." He further intimated that expansion of his aluminum industry was a "definite possibility" and that such a development might take place in California.

H. H. Fuller, president of Bethlehem Pacific Coast Steel Corp., takes a more conservative view of future expansions on the West Coast and believes augmented output will occur through improved practices which will increase both ingot capacity and yield of rolled products. He points out that it is unlikely that another fully integrated steel plant will be established in the three coastal states for some time to come because of the difficulty of providing raw materials for an economical operation. There are indications, however, that his company may make further investments in ingot capacity, but no one is talking about the details.

U. S. Steel Corp. is winding up its $100 million mill expansion program in Utah and California as it completes enlargement of facilities at Geneva and gets its Columbia Steel mill at Pittsburg, Calif., in full operation. Within 2 years Columbia expects to have completed its $30 million cold rolled sheet mill at Los Angeles. It is known that this company has studies underway which lead to the opinion that it is likely looking forward to installation of additional facilities. When Ben Fairless was recently asked if a tube mill was in prospect for the West he indicated it "might be."

Pacific States Steel Corp. is planning to enter an entirely new product field as a part of its expansion program.

Executives of several minor producers in the West apparently share Mr. Kaiser's enthusiasm for expansion and have gone into debt for millions of dollars to increase both furnace and rolling capacity.

Then, too, there are always "phantom" blast furnaces, openhearths, electric furnaces and even sponge-iron projects floating around in the blue skies from one end of the Coast to the other. There is once again talk of a blast furnace in the Portland area, a new sheet mill for Seattle, and down in Los Angeles two small sheet mills are on drawing boards, but with little probability of their ever getting to the construction site.

In the final analysis it is apparent that while present ingot capacity of the seven western states is almost large enough to meet actual present demand, diversity of finishing facilities is sorely lacking to utilize this capacity fully and provide all of the shapes of steel required. While the West has an over-capacity to make plates and bars, for example, these are not much use to the manufacturer who wants to make pots and pans, or refrigerators or stoves. It is the consensus of analysts consulted that this situation will never be completely rectified because of the impossibility of providing all such facilities necessary to meet the demand for the great variety of products utilized in the area. With completion of the projects discussed here, it is improbable that there will be any major new expansions in this territory, which has only begun to digest a giant feast brought into being within the last 8 years.

In attempting to analyze steel demand in this region 10, 20 and 50 years from now (some estimates place the market at 6 million tons in 1960), economists are faced with many imponderables. For example, one of the most experienced estimators in this area has predicted that by 1960 California may have a population between 11,200,000 and 13,500,000, but qualifies his prediction by stating that both the birth rate and national economic conditions may throw his calculations completely awry. The best estimate of present population of the seven western states is 16,135,000 persons. If the same maximum rate of growth can be applied to this entire section as applies to California, then it would seem that by 1960 the seven western states may have a population of almost 22 million.

Another consideration is that, while markets are made up of people, their age, normal occupational pursuits and standards of living affect their buying habits and their demand for products made of steel. There is considerable evidence to indicate that, while the standard of living and purchasing power of residents of the seven western states are higher than the national average, many of the wants of these people can be supplied economically only from factories and industries set up on large volume production bases, as in the automotive and appliance fields. Then, too, the far West historically has been an agricultural area, and only since the war has it emerged as a struggling industrial infant. There are many conscientious boosters for the industrial development of the West who admit that in many parts one limiting factor will be availability of adequate water supply. Temporarily at least, electric power is in short supply, and that fact is not only limiting present aluminum production in the Northwest but has shelved plans for expansion of that industry.

There seems to be little reason to believe that the West will not continue to grow at an accelerated rate for many years to come, but few of the slide rule experts see any city on the Coast becoming a second Pittsburgh, Chicago or Detroit.

nonferrous metals

The prospect that the severe shortages of 1948 may be eased this year is the happy forecast facing nonferrous metal consumers. This outlook, however, is not without the necessary qualifications of labor and power uncertainties. Prices, supported by rearmament, stockpiling and heavy domestic needs, are not likely to show any significant downward trends.

By JOHN ANTHONY
Eastern Regional Editor,
THE IRON AGE

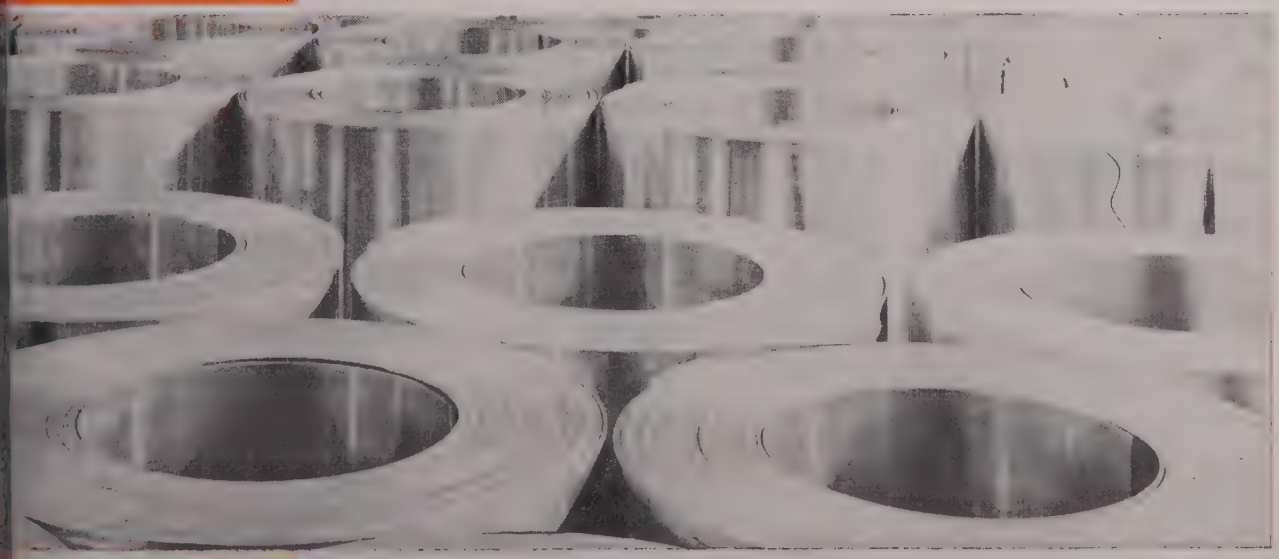
There is a good probability that shortages of nonferrous metals may end this year. This encouraging prospect, somewhat difficult to believe at year end, depends upon whether strikes will hit the mines, refineries and smelters this year, and on the continuation of imports of metals and ores at current rates.

The wave of protracted strikes that afflicted the industry last year was the greatest single deterrent to a reasonable balance between supply and demand, regardless of stockpiling and foreign aid shipments. Producers took a determined stand against the union leadership alleged to be Communist in sympathy. In most instances their efforts were successful.

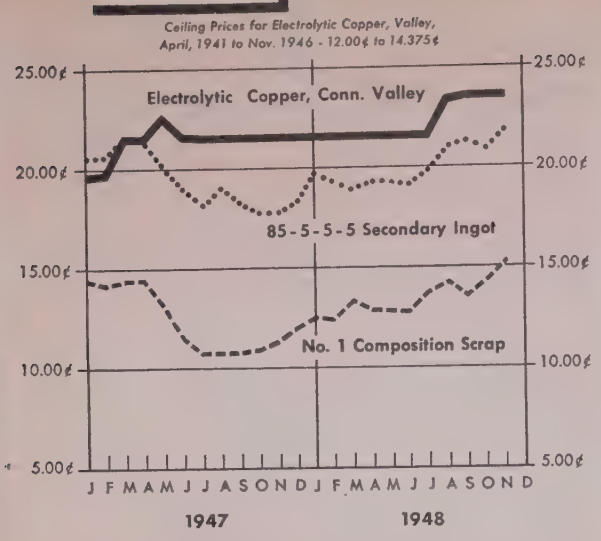
Prospects of another round of wage demands in the spring are already being studied carefully by producers. There is no doubt that they will make a stand against further increases, largely for the prospect of government price controls over basic materials if there is a further increase in prices.

In negotiating with the unions, the producers' stand against increases should be heavily reinforced by filling up of consumer and durable goods pipelines, a trend, clearly evident at year end, that can be expected to develop further in 1949. Whether a wave of strikes will grow out of the stand against wage increases depends on: (1) Recognition by union leadership of changed economic conditions; and (2) whether the Administration recognizes the interrelationship between wages and prices and takes what action is necessary to control work stoppages rising out of further wage demands. The need for a high rate of basic material production to permit domestic and perhaps foreign rearmament, foreign aid and stockpiling may encourage the Administration to work out a means of controlling work stoppages in basic industries.

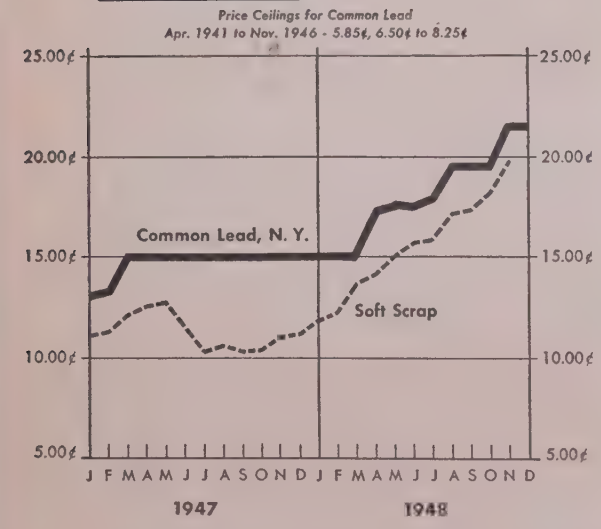
Postwar consumption of nonferrous metals has been featured by the use of heavy tonnages of aluminum and certain brass mill products as a substitute for scarce steel products. Substitution on a larger scale would



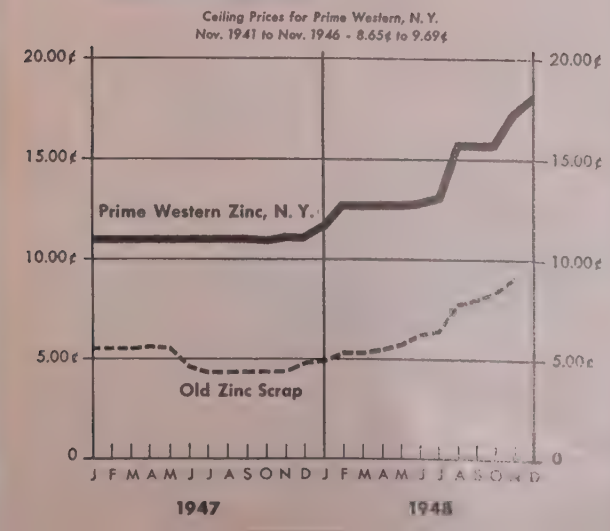
COPPER



LEAD



ZINC



probably have developed last year except for shortages in aluminum and copper. It appears that there may be an easing in certain steel markets this year, which will relieve the pressure on nonferrous metals to the extent of tonnages used for emergency substitution purposes.

Shortages of steel and cast iron pipe have been so acute since the end of the war that some homebuilders have been using large diameter copper tubing for soil, waste and vent stacks. One eastern builder, with a current development of 3000 homes, shop fabricates assemblies of copper tube waste and vent systems with brass and bronze fittings and wiped-on lead closet bends and traps. Final assembly on the job requires only five joints per house. It requires no stretch of the imagination to recognize that such applications for nonferrous metals will return to conventional materials when they become available.

Important transitions of markets have occurred in the postwar period due to significant changes in price relationships among metals. There is no doubt that prices of most metals will be reduced appreciably when the period of unprecedented demand is past. But high labor rates will still constitute a major share of mine production costs. Few in the mining field believe that labor costs can ever be depressed sufficiently to permit copper, lead and zinc prices to sink to previous levels even when demand declines.

Light metal producers have gained the most from postwar developments. Prices of magnesium and its products have scarcely been changed since the end of the war. Prices of primary aluminum and mill products were increased this year to a degree roughly comparable with increases made in steel products since the end of the war, but on a percentage basis they were well below increases in other nonferrous metals as shown in table I.

The shortage of ingot and the heavy demand for mill products has thus far prevented aluminum producers from fully exploiting the metal's price advantage. New product developments have not been brought to market on a large scale, although producers have been cultivating the building products market and some others in which they expect to retain a position when markets become competitive.

One new product indicative of the trend is the Kaiser aluminum shade screen designed for protection against insects and the heat and glare of the sun. The screen is formed in a single operation from 52S coiled sheet. The sheet is slit and louvers are formed to a 17° angle in one continuous operation. A chemical spray treatment follows to improve corrosion resistance and reduce glare. This product will be competing with an established bronze wire screening designed for the same purpose.

The bottleneck in aluminum production for the last few years was a worldwide shortage of power that limited ingot production by reduction plants. The situation was particularly acute in the United States and in Canada, and is expected to continue without change this year, although Canada recently instituted a dimout to conserve power. The power shortage is caused by the demands of growing industry and population in all sections of the country, and it is particularly

acute in the Pacific Northwest. Low water levels were also an important factor in the U. S. and Canada. Government-owned power developments provide the bulk of the energy consumed in domestic aluminum production, and priority is granted under the National Power Act to municipalities and cooperative power districts at the expense of heavy industrial users.

Low cost power is essential for reduction plants producing aluminum for sale at present market prices. Aluminum producers estimate they can afford to pay about 3¢ for the power required to produce a pound of metal. Since aluminum production requires about 8.5 to 10 kwh per lb, producers cannot afford to pay much more than 0.3¢ per kwh without raising prices.

Last year the Aluminum Co. of America began the construction of a new reduction plant at Point Comfort on the Texas Gulf Coast designed for a capacity of 35,000 tons a year. Power for the plant will be obtained from a battery of 80 diesel engines using natural gas for fuel and developing 80,000 kva. This move is the first step by the industry in peacetime in the direction of higher power costs. The plant will require at least another year for completion.

The government-built Massena, N. Y., reduction plant adjacent to a plant of its own was bought by Alcoa from the War Assets Administration for $5 million. The bid was originally made 3 years ago, meanwhile WAA sought bids from competitors in vain. A consideration in the acquisition was the agreement made by the company to release all its alloy patents and its most important process and fabricating patents for the free use of the entire aluminum industry.

Inadequate power at Massena will prevent both plants from being placed into full production. Two potlines from the old plant will be retired from production in favor of two of the three potlines in the new plant. There will be a net gain of about 4 pct in ingot production. The company's plant at Niagara Falls will be closed down this year, a loss of 20,000 tons annual ingot capacity.

The ingot shortage has prevented Alcoa from putting into production its huge new sheet mill at Davenport, Iowa. The mill has a capacity of 60,000 tons a year, and will roll sheet up to 120 in. wide. Plans have been announced by the company for the construction of a new rod, wire and cable mill near Vancouver, Wash. Permanente Metals Corp. has leased the big government-owned wire, rod and bar mill at Newark, Ohio. Reynolds Metals Co. and Permanente Metals have placed their leased plants on a 17-year basis.

There was an acute shortage of aluminum scrap all year, largely caused by active competition between primary producers and secondary smelters. The price of scrap rose to such an extent that it sold above the price of primary ingot and served to force the price of secondary ingot up by 10¢ to 12¢ above the price of comparable grades of primary. Foundries got very little primary ingot as two producers sold practically none and the third sold on a quota basis.

Carl H. Burton, secretary of Aluminum Research Institute, attacked producers for their

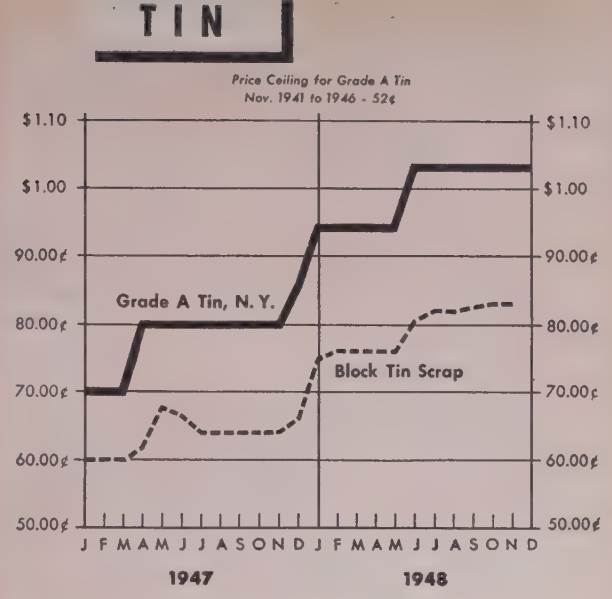
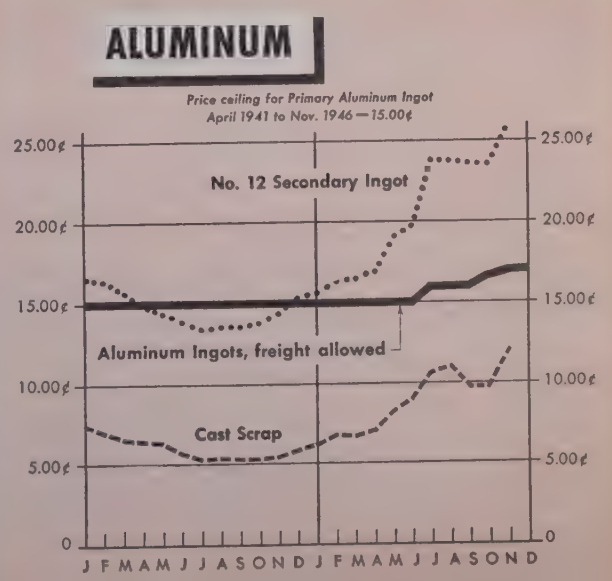
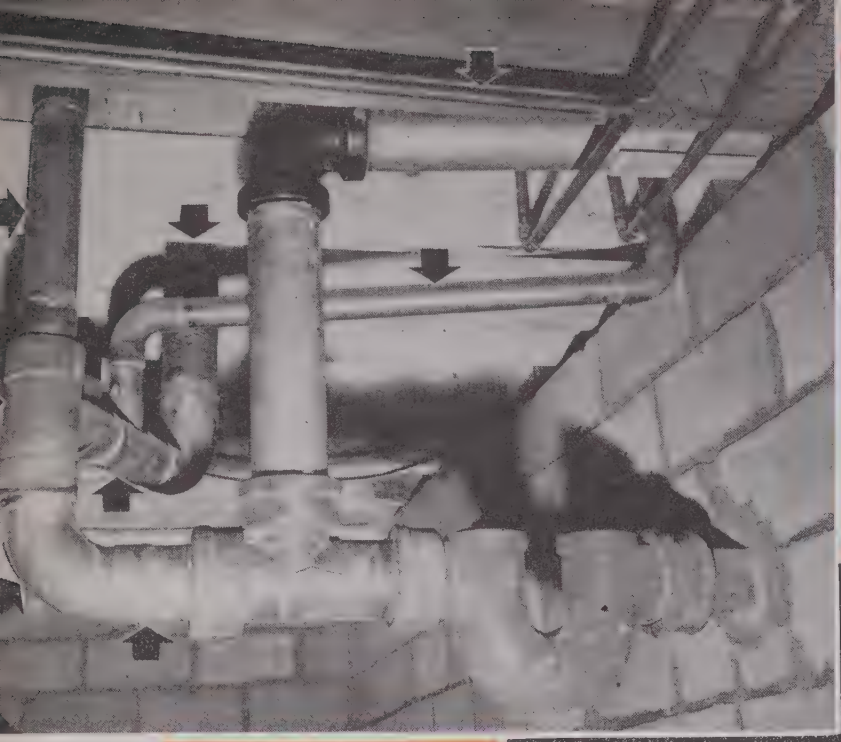


TABLE I

A Comparison of Major Nonferrous Metal Prices
(Cents per pound)

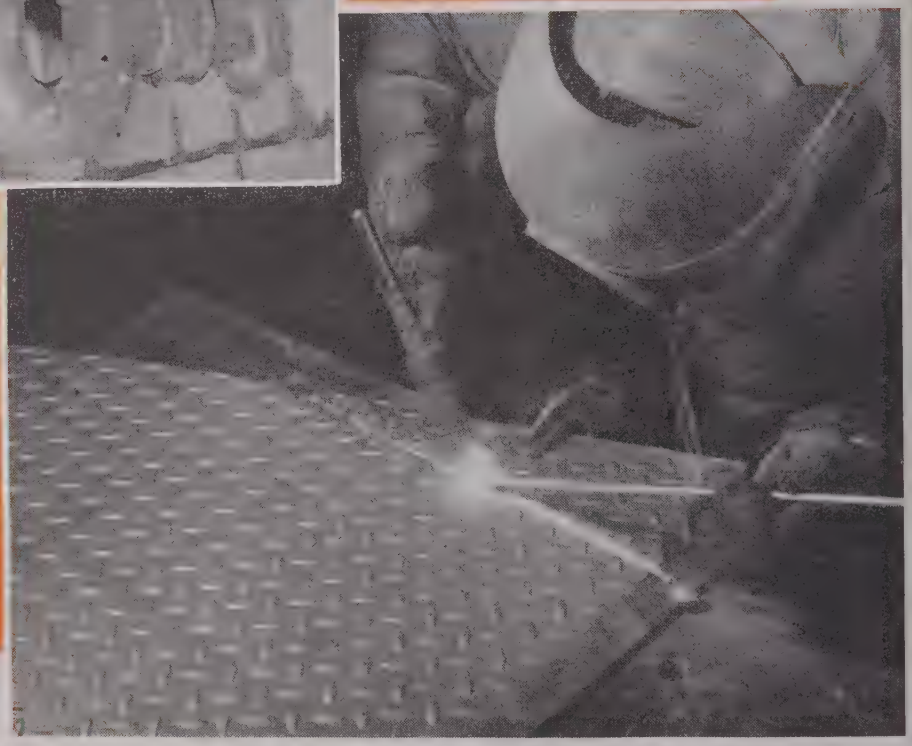
	Jan. 1 1949	Jan. 1 1948	Wartime OPA Ceiling
Primary aluminum	17.00	15.00	15.00
Antimony, N. Y.	40.17	34.53	15.84
Copper, Valley	23.50	21.50	12.00
Lead, N. Y.	21.50	15.00	6.50
Magnesium ingot	20.50	20.50	20.50
Nickel, electrolytic	40.00	33.75	35.00
Tin, N. Y.	$1.03	94.00	52.00
Zinc, N. Y.	18.16	11.06	8.40





BELOW

THIS thick magnesium dockboard, produced by Magline, Inc., Pinconning, Mich., is being welded by use of high frequency ac current. Plates 1/2 in. thick are being welded with one pass on a production basis. With equipment of adequate capacity, plates 1 in. thick can be butt-welded in a single pass.



ABOVE

SHORTAGES of cast iron and steel pipe have been so critical that some builders have been using copper tubing for soil, waste and vent stacks, as shown here. Arrows indicate copper tubing. In large housing developments, assemblies of copper tube waste and vent system are prefabricated in the shop.

policy of requesting customers to return processing scrap in order to receive favorable consideration in shipments of metal. He also charged that the Air Force was requesting its contractors to return all their aluminum scrap to producers. One observer estimates that some domestic mills could not have operated at more than 60 to 70 pct of current rates if it were not for conversion of scrap on a toll basis. At year end, prices of scrap and ingot were easing.

Canadian aluminum was authorized to be purchased by western Europe from Economic Cooperation Administration funds to the extent of $26 million to the end of September. For the six month period, the authorization called for 100,000 tons of ingot at a price of about 16¢ per lb, the bulk of which was to go to the United Kingdom. During the first five months of this period, 22,000 tons of scrap, ingot and sheet were imported into the United States at markups over domestic prices estimated at 50 to 70 pct. The bulk of the imports was in the form of scrap, but the scrap market during the period of heaviest imports was as high as the price of primary ingot.

Shortages of aluminum products were responsible for an active gray market in which sheet and coil products sold for 10¢ to 20¢ above the market. Bars, rods and tubing sold at somewhat lower markups. Shortages grew in intensity during the year and gray market prices were highest toward the end of 1948.

Demand for aluminum by the rearmament program was only beginning to make its appearance at the end of the year. It has been estimated that the 70-group Army aircraft program, with supporting Navy planes, will require some 40,000 to 50,000 tons of aluminum per year just for maintenance and replacement. But the National Military Establishment is thinking in terms of a great variety of military equipment to be airborne, constructed principally from light metals.

Domestic aluminum production is expected to reach 620,000 tons in 1948, a peacetime record and 50,000 tons above 1947. This tonnage is about two-thirds of peak wartime production in 1943.

Copper, lead and zinc, cadmium and antimony were in short supply throughout the year. In the latter half, shortages of the first three metals were intensified due to a wave of long drawn out strikes and a more aggressive stockpiling program by the government.

It is difficult for metal producers and consumers, for years confronted by overwhelming demand and limited production, to visualize the prospect of an early change in metal markets. This is particularly true in view of long term needs for stockpiling, rearmament and foreign reconstruction. But accumulating evidence of growing satisfaction of consumer and industrial needs is hard to overlook. It appears now that industry may be entering a period of inventory reductions and restricted industrial production. There are no heavy inventories of nonferrous metals outstanding, contrary to the situation prevailing after World War I. But metal prices are very high, and there is no doubt that demand would be curtailed by a declining market, despite continuing requirements of public utilities and the transportation and construction industries.

Stockpiling, rearmament and exports of metal paid for largely by ECA funds will provide a strengthening and stabilizing effect on the metal markets for at least several years. But the volume of this type of business is small by comparison with requirements of the consumer and durable goods industries. It is probable that the rate of stockpiling and rearmament consumption may be increased by Congress this year. But the increased consumption of metals by these programs may be too small to bridge the gap created by generally restricted consumption, unless the industry is afflicted by a wave of strikes this year.

Statistics compiled by Simon D. Strauss, manager of sales, American Smelting and Refining Co., show significant trends in the production and consumption of copper, lead and zinc. The 1936-38 period brought production and consumption of nonferrous metals here and abroad close to all-time record levels. Yet domestic mine production of copper and zinc in the postwar period has been significantly greater than in the prewar period. Lead production was somewhat lower. In the prewar period, the United States was an exporter of copper, an importer of lead, and roughly self-sufficient in zinc production. In the postwar period, this country became a large importer of all three metals, but the change in the nation's self-sufficiency in these metals is due to an amazing increase in consumption rates. Copper consumption is 100 pct higher; zinc 50 pct, and lead 40 pct.

These conclusions indicate that there could be a very heavy shrinkage in the demand for the three metals before domestic consumption would drop below domestic mine production. It is a fair assumption that there may be little controversy over the need for renewing the copper tariff suspension, which ends next March, for another period of more than a year.

The United States is still the world's largest mine producer of copper, lead and zinc, a position it has held consistently for more than 30

KAISER aluminum shade screen, a new light metal product, is produced from coiled sheet by slitting, as shown here, and forming in one continuous operation, followed by chemical spray treatment to enhance corrosion resistance and reduce glare. The screen has 18 louvers to the inch, set at an angle of 17° to protect from the direct glare of the sun and act to bar insects at the same time.

years. The domestic mining industry is continuing to develop ore bodies which should permit this country to continue as the leading producer of copper for many years. Magma Copper Co. is developing the San Manuel deposit near Tucson, Ariz., with reserves estimated at 425 million tons. From ore containing only 0.8 pct copper, this mine is expected to produce 60,000 to 65,000 tons of copper annually when it gets into production in about 5 years. Anaconda Copper Co. is developing a large body of low-grade ore at Butte, Mont., expected to produce about 50,000 tons a year when it comes into full production about 4 years from now. Reserves are estimated at more than 130 million tons of ore above the 3400-ft level.

An interesting copper development in prospect is that of the Copper Range Co. in northern Michigan. Estimates indicate about 200 million tons of developed and probable ore containing 1.1 pct copper and 0.2 oz silver per ton. Preliminary tests indicate that 86 pct of the total copper content might be recoverable in a concentrate averaging 16 pct copper.

Important developments in the zinc mining field include the New Jersey Zinc Co. development program at Friedensville, Pa. Although no information is available on the extent of the new ore reserves, they are believed to be substantial and mine production will begin in 1951.

Substantial new reserves are known to be under development in the Wisconsin-Illinois area in a district averaging 4 to 6 pct zinc and less than 1 pct lead. No information on the extent of the new reserves has been made available, but Calumet & Hecla Consolidated Copper Co. will begin mine production this year near Schulsberg, Wis., and the Eagle-Picher Co. has developed a tract near Galena, Ill.

According to a statement by Francis Cameron, vice-president, St. Joseph Lead Co., before the American Mining Congress late last year, "exploration and development for copper, lead and zinc since the war has proceeded at an accelerated rate, due in part to the stimulus of high metal prices but, to a greater extent, from the need at established operations of proceeding with developments which had to be deferred during the war years. As a result, most of the major producing mines are in the fortunate position of being able to establish a normal balance between their rate of extraction and ore reserves."

It can be observed that the orebodies now being opened up are generally of low grade, but improved techniques of mining and concentration are expected to permit profitable recovery of the lower grade ores. It is interesting to recall that the average grade of copper ore from Kennecott's Bingham Canyon mine was 2 pct when the property was first put into production. Ore from that mine averaging less than 1 pct copper is now being treated profitably. The southeastern Missouri ores of St. Joseph Lead Co. had a lead content of 3.5 pct in 1930, but at present it is averaging 2.25 pct.

Mining companies are planning ahead for continued growth in the domestic consumption of copper, lead and zinc, in line with population growth and the new construction required by gradual westward migration of population and industry. There is no doubt that the opening up of the low grade reserves indicates a faith in the maintenance of reasonably high average metal prices for years to come.

Foreign production of copper and zinc has failed to make the same gains as the domestic industry. In lead, the domestic loss was considerably exceeded by the loss of foreign production. But foreign consumption rates for all three metals have declined very significantly in the postwar period, a fact that permitted this country's heavy gains in consumption. In the prewar period foreign consumption of all three metals was approximately twice the volume of U. S. consumption. Postwar consumption of copper and zinc by the U. S. is higher than foreign consumption, and U. S. consumption of lead is exceeded by foreign consumption by only 145,000 tons in the three-year postwar period.

Foreign purchases of metals from dollar countries had been all but discontinued before the enactment of the ECA program, due to worldwide dollar shortages. Most observers believe that when the figures are in, they will disclose lower export tonnages in 1948 than in 1947, regardless of ECA. The principal reason is that high metal prices work a severe hardship on foreign consumers who have to pay in depreciated currencies the dollar equivalent of their ECA metals purchases.

The Foreign Assistance Act of 1948 which established the Marshall Plan contained a provision designed to encourage expansion of strategic mineral production abroad, along the lines of the recommendations of the Herter and Harriman Committees. Such increased production was to be in addition to their own requirements and what was required for normal commercial transactions, and was to go to the U. S. stockpile or industry in repayment of the 20 pct of foreign aid funds made available in the form of loans. American business interests were to be granted the same rights as the nationals of ECA countries in the development of resources. The Herter and Harriman Committee recommendations foresaw possibilities of increased mineral production for delivery to this country of between $142 million and $223 million annually, at 1947 prices, for a period of 20 years.

So far this development has not materialized. Belgian lead and zinc smelting capacity is not being utilized because of the inadequacy of transportation facilities. According to Evan Just, director, Strategic Materials Div., ECA, there are no possibilities of further zinc production in ECA territories. There is one important source of additional lead coming into production in French North Africa, and Northern Rhodesia is planning for production. Programs are in effect for increased copper production in Northern Rhodesia and the Belgian Congo, but they will take several years for full development. Domestic capital has not yet been invested in foreign minerals production under the ECA program, although it is said that there is a growing interest in the prospect.

A new sulfide copper ore plant is being built at Chuquicamata, Chile, by the Chile Exploration Co., a subsidiary of Anaconda Copper Mining Co. The company expects to produce about 150,-

000 tons of copper a year from the sulfide ores. Present production from oxide ores will continue at about 120,000 tons a year.

Kennecott Copper Co. has joined with the Anglo-Transvaal Consolidated Investment Co. to form a $4 million company identified as the Kennecott-Anglovaal Exploration Co. Ltd. for prospecting and exploration of mineral areas in the Union of South Africa.

Domestic mining has been restricted to some extent by a long term labor shortage. This will probably continue due to a general reluctance to take up mining as an occupation.

Complete statistics on the government's stockpiling program have not been made public. But objectives for some metals have been published. It is known that sales of copper, lead and some other metals to the government in the first half of the year lagged, because of the heavy demand by industry and also because the government's program was not pressed aggressively enough by purchasing officials. At mid-year, new objectives were set up and third quarter objectives were announced.

By the end of June, the Munitions Board wants to buy and obtain delivery of the following tonnages to add to its existing stockpiles:

Copper	**90,000 tons**
Lead	**53,000 tons**
Zinc	**40,000 tons**

The government is already carrying a stockpile of about 250,000 tons of slab zinc and 175,000 tons of zinc concentrates. Stockpile objectives for other nonferrous metals for the third quarter of 1948 were as follows:

Tin	**4500 long tons**
Nickel	**7500 tons**
Cadmium	**150 tons**
Chromite	**30,000 long tons**

As the result of the aggravated shortages of copper, lead and zinc during the latter half of the year, many consumers went into the gray market to pay heavy premiums for foreign metals and secondary produced from high priced scrap. In this development metal was bought at top prices reported to be as follows: Copper, up to 28¢; lead, up to 26¢; zinc, up to 20¢. In addition, consumers who are not ordinarily scrap buying factors went into the scrap market to compete with custom smelters and ingot makers for available tonnages, in order to get metal for conversion on a toll basis. This served to raise the price of scrap well above the maximums that could be paid by custom smelters for their own production for sale at market prices. Scrap prices began to fall at the end of the year.

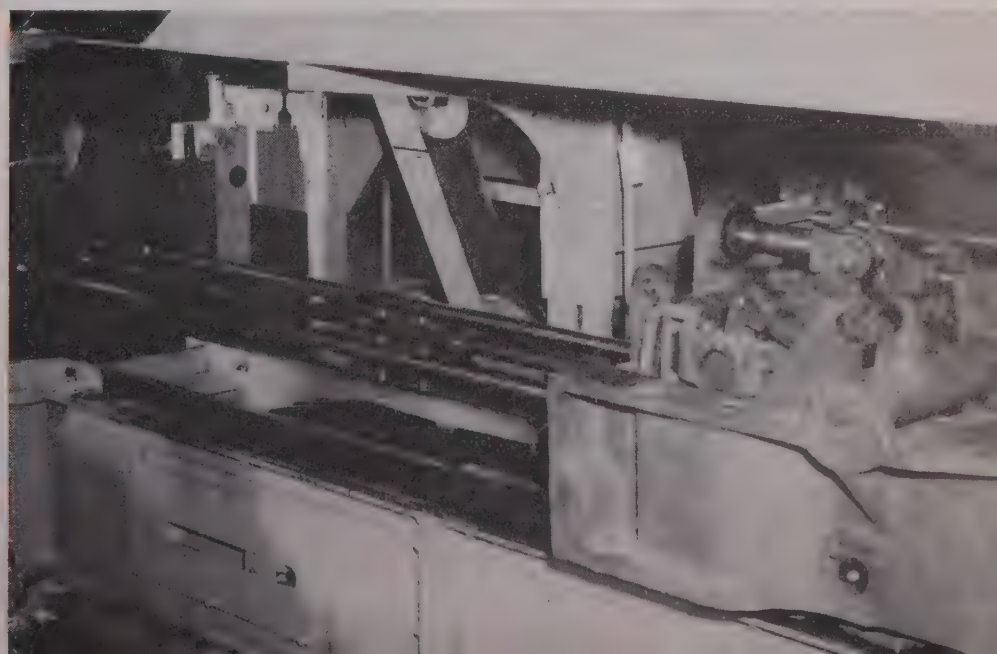
The most important strikes in the industry included the strike of railroad workers at the Bingham Canyon, Utah, mine of Kennecott Copper Co. that closed down the mine for more than two months and was still in effect near the end of the year. The cause of the strike was failure of union and company to agree on a wage increase. At year end, the loss of copper was estimated at about 50,000 tons.

A strike of miners at the St. Joseph Lead Co. properties in southeastern Missouri, which originated in a wage demand, was prolonged by the failure of union leaders to execute non-Communist affidavits. Eventually the workers voted to go back to work without any union to represent them. This strike caused a loss estimated at 25,000 tons of lead.

Strikes of longshoremen on the East and West Coasts toward the end of the year created a situation that compounded the difficulty of consumers. Imports of metals and concentrates were delayed for some time and aggravated the shortages.

Demand for brass mill products was very spotty in 1948. The demand was heaviest for tubing and brass pipe. New tube mills have been built by Revere Copper & Brass, Inc., at Los Angeles, and by the Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., Decatur, Ala. Demand for tubing for housing is very heavy and would probably require full production by all plants to meet the demand. At present the principal difficulty in tube production is in obtaining copper for billet casting.

AT the new Decatur, Ala., tube mill of the Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., practically all drawbenches are designed to draw three tubes at a time, as illustrated here.



metal finishing

Noteworthy advances in basic metal finishing knowledge, the improvement of instruments for studying electroplate quality, the development of improved nonmetallic finishes, commercial position of the industry, and general technological progress during 1948 are highlighted by the author. The silicones, strippable plastic coatings, unplasticized vinyl lattices and water dispersions of synthetics were of particular interest in the field of nonmetallics.

By ADOLPH BREGMAN
Consulting Engineer,
NEW YORK

Passage of another year has seen steady progress in metal finishing, with many of the voids in the fundamental knowledge which is the backbone of plating and finishing being filled in.

Knowledge of the properties of electroplates in engineering and industrial applications has been strengthened. More accurate, quicker and generally more effective instruments for studying plate quality have been developed. Control of impurities and treatment of plating plant wastes have received considerable attention. And the promise foreseen in periodic reverse plating has largely been justified.

The nonmetallic finishes have continued to multiply in number, with silicones, strippable plastic coatings, unplasticized vinyl lattices and water dispersions of synthetics commanding growing interest.

Electropolishing continued to command wide attention and a number of workers in this country and abroad reported on various phases of it. Among the papers were the following:

"The Character of Roughness on the Surface of Electrolytically Polished Copper" by Henri Frisby (Comptes rend. 224, 1003-1005, March 31, 1947) reports that investigation of electrolytically polished copper directly after removal from the bath showed much less roughness than usual. It is believed that such a surface is subject to oxidation; when left in the air, it becomes covered, in a few minutes, with several monomolecular layers of cuprous oxide.

"Examination of Electropolished Surfaces by Means of Electron Diffraction" by J. Trillat (Comptes rend. 224, 1102-1003, April 14, 1947) states that examination of surfaces polished electrolytically in a perchloric-acetic acid bath showed Beilby's film, the amorphous layer which is always present on the surface of mechanically polished specimens, to disappear after electropolishing.

"A Contribution to the Study of Electropolishing Processes" by R. Piontelli, D. Ports, and L. Arduini (Metallurgia Ital. 3-11, Jan.-Feb. 1947), describes a new experimental installation for the study of electropolishing

processes permitting a very convenient reproduction of the anode voltage curve as a function of time, current density and other factors.

"Industrial Electropolishing" was discussed by Charles L. Faust, Battelle Memorial Institute. Factors which influence the decision to use electropolishing were given and commercial experience in electropolishing steel, stainless steel, brass and aluminum was cited. The paper gives cost data including direct charges for chemicals, labor, electricity, racks, etc.

"Increase of Tool Life by Electropolishing plus Chromium Plating" was the subject of a paper by G. Ye. Pochtar' and A. M. Gur'ev. (Stanki i Instrument 18, No. 3, 27, 1947) ; Translation No. 1993 by H. Brutcher. The authors recommend chromium plating preceded by electropolishing for high-speed tools containing 4 to 9.5 pct W to increase tool life 50 to 150 pct. Data on optimum electropolishing and plating conditions are included.

"Electrolytic Polishing of Brass Pressings" by P. Berger, Wm. Bate Ltd., Walsall, England, dealt with a process for the electrolytic polishing of brass pressings and with the industrial application of the process. An electrolyte typifying the form finally adopted had the following composition: H_2O, 70 to 90 pct; H_3PO_4, 10 to 30 pct; H_2CrO_4, 180 g per liter; $Na_2Cr_2O_7.2\ H_2O$, 420 g per liter; H_2SO_4, 80 to 95 g per liter; HF, 3 to 6 g per liter; and propionic acid, 80 to 150 g per liter. The process is not applicable to articles made from brasses containing more than 0.3 pct Pb or Sn. For such articles a different electrolyte, with a high phosphoric acid content and with little chromic acid present, has been developed. Patents have been taken out in England and elsewhere for these electrolytes and procedures.

Properties of Electroplates

Continued interest was evinced in the structure, physical properties and stresses in electroplates. Heussner, Balden and Morse of Chrysler Corp., reported on "Some Metallurgical Aspects of Electrodeposits," discussing mechanical properties, hardness, tensile strength and brittleness. "The Influence of Internal Stress on the Structure of Electrodeposits" was described by M. R. J. Wyllie (J. Chemical Physics 16, 52-64, Jan. 1948). In this paper, data on the properties of chromium electrodeposited from a standard chromic acid electrolyte were examined and it was shown that the data agree with the assumption that the preferred orientation found is the result of a slipping process, analogous to cold-working, which occurs during deposition when the internal contractile stress reaches a certain critical value. The type of orientation found also agrees with the theory. Certain anomalies in the stress and orientation of silver, nickel and aluminum deposits were studied experimentally, and the results were explained on the basis of the above theory. In addition, the possible mechanism of internal stress formation in electrodeposits was examined.

"The Spiral Contractometer, a New Instrument for the Measurement of Stress in Electrodeposits" was presented by Abner Brenner and S. Senderoff, National Bureau of Standards.

M. R. J. Wyllie published "A Semi-Quantitative Method for Measuring the Ductility of Chromium Electrodeposits" (Electrochem. Soc. Reprint 92-5, 1947). In this method, the Dubpernell test was adapted for assessing quantitatively both initial porosity and cracking of the deposits after elongation. It was shown that, under the conditions used, porosity always takes the form of small circular holes in the deposits. Relationships of porosity and cracking and the effects of electroplating bath temperatures and other factors were determined.

Abner Brenner and E. Kellogg, National Bureau of Standards, made an important contribution to the industry in "A New Method for Magnetic Measurement of the Thickness of Composite Copper and Nickel Coatings on Steel." The method effectively widens the field for nondestructive testing of plated deposits originated by the senior author through his development of the Magnegage in 1937. By measuring the attractive force between the specimen and two permanent magnets of different strengths and making comparisons with a set of calibration curves prepared from standards, the total thickness of the deposit and the relative thickness of copper and nickel layers can be measured with fair accuracy.

"A Surface Reflectometer for Evaluating Polished Surfaces" was developed by E. A. Ollard (J. Electrodepositors' Tech. Sec., 1948, 24, 1-8). The instrument quickly assesses the polish on a flat metal surface with a single reading. It is not claimed that the method will give an absolute value of the degree of polish, but merely that it will afford a quantitative comparison of different surfaces in line with the results of visual examination.

"An Electrolytic Thickness Tester for Plated Metal Coatings," developed by H. T. Francis, Armour Research Foundation, permits accurate measurement of the thickness of electrodeposited metal coatings. The principle of the instrument is the anodic dissolution of a defined area of the plated metal, using the current-time product as a measure of the thickness. The stripping current is held constant during a test and the removal time is automatically indicated. Successfully measured coatings include: tin, zinc, lead cadmium, copper, chromium silver, gold, and brass on steel; and tin, zinc, lead and chromium on brass or copper. The accuracy is high, 30 microinches of tin on steel being measured with an accuracy of ± 2 pct.

Plating Waste Disposal

More and more thought is being given by the plating industry to the problem of waste disposal, especially in localities where the output is large and the chemicals may have harmful effect in stream pollution. A. L. Reidl (Chem. Eng. 54, 100-101, July 1947) described a unique system of upflow limestone beds and aeration used by General Electric's Philadelphia Works for neutralizing the effluent from acid pumps. Experimental data regarding the proper size of

the beds and the optimum rate of flow of the acid was given.

"The Treatment of Plating and Pickling Shop Wastes" by E. W. Mulcahy (J. Electrodepositors' Tech. Soc. 22, 227-242, 1947), dealt with methods of neutralizing acid from waste liquors and rinse water; the precipitation of chromium, copper, iron, etc.; the removal of cyanide in effluents; the construction of effluent treatment tanks of suitable acidproof materials; the measurement of flow and recording of pH; the removal and scrubbing of nitrous oxide fumes from bright dipping plants; data on intake-air velocity for extractors; hard rubber as protective lining for tanks and fan casings; recovery of waste pickle liquors from industrial pickling plants; and a description of a plant for the crystallization of ferrous sulfate.

In "Treatment Works for Plating Wastes Containing Toxic Metals and Cyanides" (Water and Sewage Works 94, 267-271, August, 1947), G. E. Barnes described the processes that have been developed to treat wastes at Talon, Inc. Starting with simple provision for neutralizing the spent pickling liquors with lime, improvements were begun to remove cyanides and chromium along with other toxic metals such as copper and nickel.

Under the present critical shortages, the discussion of "Conservation of Chromic Acid" by K. G. Soderberg was most timely. There are three principal ways in which chromic acid consumption can be cut in chromium plating. Two of them deal directly with waste curtailment, namely, lessening of spray losses and of dragout losses. The third deals with reduction of the unavoidable losses by spray and dragout through lowering of the chromic acid content of the plating solution.

The volume of drag-out can often be reduced very substantially. Soderberg, in a systematic study of drag-out, showed experimentally that drag-out can be reduced by: (1) Withdrawing the part slowly from the solution; (2) increasing the drainage time above the solution (hand tanks can be equipped with drainage rods for the racks or hooks); (3) keeping the withdrawal time, for a given total drag-out period, as long as possible and the drainage time as short as possible; (4) racking the parts so that solution can flow off at a tip or corner, so that there are no horizontal surfaces and so that there are no solution pockets; and (5) arranging the rack so that drip from one part does not fall on another part below it.

There certainly is no justification under present conditions for the use of the 55 oz per gal bath instead of the 33 oz per gal bath. In fact, the work by Grube and Clifton has shown that satisfactory bright chromium deposits can be had from baths containing as little as 10 oz per gal H_2CrO_4 provided that other conditions are changed accordingly. To permit the use of the same current generating equipment with its limit on voltage output, the drop in solution conductivity usually must be counteracted by the use of higher bath temperature. To make up for the detrimental effects of low chromium content and high temperatuure on the throwing power, the chromic acid to sulfate ratio must be raised beyond its usual value of 100:1 and a balance struck between the brown to iridescent stain formation found at high ratios and the low throwing power encountered at low ratios.

Plating Developments

Two days of the Fall Meeting of the Electrochemical Society were largely devoted to electrodeposition subjects. M. L. Holt, University of Wisconsin, and his coworkers gave not less than three papers on tungsten alloy plating. Two dealt with plating iron-tungsten and cobalt-tungsten from citrate baths with high efficiency, and one described a catalytic reduction theory for the effect of the necessary codepositing metals, iron, nickel and cobalt. Chromium seems to belong to the same group according to work done at Rennselaer Polytechnic Institute using a chromium-tungsten bath of lower efficiency.

C. G. Fink and V. M. Kokras, Columbia University, studied electrodeposition of germanium and obtained only flash coatings unless codeposited with copper.

W. A. Wesley and H. R. Copson of International Nickel Co. found that up to 0.00003 in. thick nickel immersion deposits on steel could be obtained in nickel chloride solutions. Very thin deposits have been used in the preparation of steel for fire-enameling for many years, but have not been closely controlled. The present heavier deposits are made adherent by high temperature heat treatment.

Plating of high tin-zinc alloys from stannate-cyanide baths was the subject of a paper by J. W. Cuthbertson and R. M. Angles of the Tin Research Institute, Middlesex, England. The resulting coatings had almost constant composition over a wide range of current densities and were said to be superior in rust protective value to equally thick zinc or cadmium coatings and, in addition, were easily solderable.

A new bath for nickel plating, making use of the orthophosphates, was described by C. B. F. Young and E. S. Roszkowski of Brooklyn Polytechnic Institute. The coatings were matte and adherent.

"Smoothing Action as a Mechanism in Bright Nickel Plating," by G. E. Gardam (J. Electrodepositors' Tech. Soc. 22, 155-168, 1947), reported that some nickel solutions deposit a greater thickness of plate in small scratches and pits than on the higher points to give a more nearly plane surface. Photomicrographs show that nickel solutions containing some zinc, cadmium or iron have a strong smoothing action.

I. Larson of E. I. duPont de Nemours & Co. and R. W. Moulton and G. L. Putnam of the University of Washington reported the physical properties of iron deposited from the Ekko chloride bath. Average tensile strength varied from 37,700 tc 68,700 psi with elongations of 0 to 12.5 pct, the main bath variable being pH.

At the annual meeting of the AES, a paper entitled "Diaphragm Tanks to Eliminate Roughness in Copper Plating," by R. H. McCahan and

C. E. MacKinnon, E. I. duPont de Nemours & Co., described a method for eliminating roughness of cyanide copper electrodeposits through the use of a relatively impervious canvas diaphragm separating the anode and cathode sections, and elimination of exposed metal surfaces in contact with the cathode electrolyte.

"Bright Barrel Plating of Nickel and Zinc" by L. A. Chesworth, United-Carr Fastener Corp., gave information on a barrel plating production unit for the plating of bright nickel on small parts.

In the paper "Deposition of Metals on Plastics Employing Reduced Copper Films," by Harold Narcus, Electrochemical Industries, Inc., a method was described for plating on nonconductive materials, especially synthetic resins, employing reduced copper films in lieu of the presently used silver films.

Another contribution to the art of plating on nonmetallics was an article "New Types of Silver Coatings," by P. P. Hopf (Electronic Engineering 19, 193-194, 198, June 1947), describing an improved silvering preparation and an improved technique for applying printed circuits to nonmetallics, especially ceramic materials. The solution is a stabilized colloid of metallic silver containing a minimum amount of silver oxide. The usual silk-screen printing method is replaced by an offset-printing technique. An alternate method, especially useful for application to plastics, consists of fusing the silver to the plastic by high-frequency heating.

"Blistering of Silver Plating at High Temperature" was investigated by C. F. Floe and M. B. Bever (Metal Progress 53, 247-248, 1948). Experiments carried out to determine the cause of blistering on turbine and jet-engine parts showed that blistering required the presence of oxygen or of water vapor at 800° and 1200°F. Tests at 1400°F indicated that heating in nitrogen for a sufficient period removed hydrogen by diffusion while, on heating in air, oxygen was absorbed and formed water vapor by reaction with hydrogen. The authors believe that hydrogen and oxygen embrittlement are misnomers which should be replaced by water vapor embrittlement.

The light metals came in for a large amount of attention, as usual.

"Brunak, A New Anti-Oxidation Surface Treatment for Aluminum," was made public by M. H. Bruno and P. J. Harsuch (Modern Lithography 16, No. 4, 51-53; National Lithographer 55, 26-27, 85, 1948; and C.A. 42, 4077, 1948). In certain localities, aluminum plates used in lithography often develop a pitting type of corrosion believed to be associated with the local water supply. This corrosion can be prevented or greatly retarded by bathing the plates in a solution containing 1 fl oz of 48 pct HCl and 9 oz of $(NH_4)_2 Cr_2 O_7$ in 1 gal H_2O.

"A New Surface Treatment for Magnesium," by A. L. Kohl and H. Waterman, (IRON AGE 161, 50-55, Jan. 22, 1948), consists of anodizing the parts in a hot saturated sodium carbonate solution. A white crystalline coating is formed which is an electrical insulator and very resistant to abrasion. Corrosion tests indicate the value of the coating for corrosion resistance and also as a paint base.

A process was developed by Dow Chemical Co. for electroplating on magnesium. The process is based on the application of a zinc immersion coating to the mechanically and chemically cleaned magnesium surface. Subsequent to this, a flash of copper is applied followed by a heavier plate of copper. Standard coatings of nickel and chromium or other combinations can then be applied as desired. While the preparation of the surface and application of the zinc coating are somewhat specialized for magnesium, the operations are quite simple to perform and have been operated successfully on a semiplant scale.

A paper by J. J. Lander and L. H. Germer of Bell Telephone Laboratories, "Plating Molybdenum, Tungsten and Chromium by Thermal Decomposition of Their Carbonyls," described the plating of molybdenum and tungsten, and of compounds and alloys of these metals, from their carbonyl vapors. Either molybdenum or tungsten can be deposited upon a base metal as a coherent and adherent coating. The hardness of the coatings depends upon the carbon content of the plate which can be regulated over a wide range. Those coatings containing considerable carbon are harder than sapphire.

"Metallic Coating of Wire" by Herbert Kenmore and F. L. Durr (Wire and Wire Products 23, 135-138, Feb. 1948), described a method for electroplating wire of various metals and alloys with different metals by a continuous automatic process.

"A Method for Welding Sheet Aluminum to SAE 4140 Steel" by W. F. Hess and E. F. Nippes, Jr. (National Advisory Committee for Aeronautics, Washington, Wartime Report W-102, Jan. 1944) was made public. The investigation involved the study of a large number of different metals between aluminum and steel for the purpose of securing good bonds of high strength and thermal conductivity. Silver was found to be the most satisfactory intermediate metal. It is electroplated onto the steel and the aluminum and the silver are then welded together. It was necessary also to develop special techniques for the surface preparation of the steel for electroplating and of the aluminum for welding, and for the avoidance of martensite formation in the steel during welding.

"Stripping of Rhodium Plating," a problem which has always troubled platers was outlined by M. Shapiro, Gillette Safety Razor Co. (Metal Finishing, Feb. 1948). On articles which can be refinished by polishing and buffing after stripping without spoiling tolerances, or on articles which have to be stripped in as short a period of time as possible without regard for appearance, a dilute reverse current muriatic acid solution is used. The solution is at room temperature and at 6v is able to penetrate the rhodium and strip the nickel from the base metal, taking the rhodium along with it. The operation requires 5 to 10 min, depending on the thickness of the rhodium plate and the concentration of the muriatic acid.

PARTS being passed through a channel of infra-red drying lamps at the Sharon, Pa., plant of Westinghouse Electric Corp.

"Periodic Reverse Current Electroplating" is undoubtedly one of the most interesting recent processes in electroplating. G. W. Jernstedt, Westinghouse Electric Corp., is responsible for much of this development by which polishing costs are reduced markedly while at the same time the plated deposit shows superior qualities of strength, elasticity, density, and freedom from flaws such as porosity. It involves a novel plating cycle in which plating current is reversed briefly at short periodic intervals to deplate what may be unsound and inferior metal deposited in the previous plating period. Many microscopically thin increments of sound metal are built up to make a deposit more dense and of greater homogeneity than that possible with conventional continuous current methods. Work has been done with silver, copper, brass, zinc, tin, cadmium, gold, nickel and iron. Equipment for timing the cycles is available in mechanical and electronic types.

"Bright Nickel Plating Practice" was summarized by H. Silman for the Electrodepositors' Tech. Soc. (Advance Copy, April 1948). His general conclusion from a recent survey of American plants and practice is that there is an increasing divergence from the methods in general use in England. In some cases in the United States, substantial advances in technique have been achieved; in others, some of the advances in speed of production and cost have been offset by reduction in quality and appearance.

To summarize briefly, the major trends of electroplating technology at this time may be stated as follows:

(1) Increased attention to the physical properties and stresses in electrodeposits, especially as related to engineering uses.

(2) Prevention and elimination of harmful impurities in plating solutions and deposits.

(3) Attempts to obtain smoother and more uniform deposits by "leveling" in electroplating.

(4) Treatment and neutralization of noxious waste materials from plating plants.

(5) Periodic reverse plating to obtain smoother, denser and more adherent deposits, and to reduce polishing costs.

(6) Sprayed polishing and buffing compounds, to increase output and reduce the consumption of materials.

Commercial Aspects

Commercially, electroplating as an industry, typified by the job platers, had a poor year. An oversupply of plating facilities and an undersupply of volume of business held the rate of operations in the New York district down to about 50 pct of capacity all year, until the Fall when it rose to about 60 pct in November and December—still a far from satisfactory rate, especially with price-cutting rampant. A survey of profits in 1947 showed that returns in this field are not commensurate with the efforts involved, as shown in table I.

The situation in materials and supplies was also difficult. Shortages exist in chromic acid (acute), caustic soda, cadmium, and nickel (getting tighter). Steel for customers is still short and aluminum is joining that growing company. Prices of supplies are still rising generally, with some exceptions such as buffs and compositions.

Labor conditions have been quiet. Good skilled help is short during busy season. General increases are still the rule, ranging from 5 to 15¢ per hr.

The National Assn. of Metal Finishers under the leadership of Paul Henning, president, and R. M. Shock, secretary, has completed a most productive year. The Metal Finishing Manual, with technical, operating and business data for job platers, has been published; also, a National Directory of Job Platers & Metal Finishers has been compiled. The NAMF is working actively with the Dept. of Commerce in an effort to ease shortages by reducing export quotas.

Published material on the economics of plating includes "Can Your Plant Do Its Own Plating?" (IRON AGE, Dec. 2, 1948) by the present author, which describes the dangers likely to be encountered in setting up a captive plating plant and discusses the considerations to be weighed in taking such a step; and "Practical Methods Of Cost Finding and Estimating on Metal Finishes," the practice among job platers in the New York district. In most cases, the figures were based upon cost of labor, but tank-hour and barrel-hour figures with due allowance for the cost of precious metals, expensive nonmetallic coatings and similar special materials are also included. This paper, also by the present author, was read at the Annual Convention of the AES.

An outstanding contribution to the knowledge of cost finding and estimating in plating was "Determining Barrel Plating Costs" by R. J. O'Connor, Contract Plating Co. (Metal Finishing, Oct. 1948). Another useful article was "Plating Room Costs" by H. E. Snyder, Loyola University (Plating, Nov. 1948).

Nonmetallic Finishes

In this field, an interesting and informative outline of principles and processes appeared, entitled "Organic Coatings for Metals" by E. E. McSweeney, Battelle Memorial Institute (Plating, April 1948).

Organic coatings usually comprise at least two types of materials, vehicle and solvent, and many contain a third, pigment. Until about 25 years ago, the number of materials in each of these three classes which were available to the coatings formulator was limited. Now, the basically different materials number in the hundreds, and the significantly different variations within any specific class of material—alkyd resins, for example—bring the number of materials used by the coating manufacturer well into the thousands. From this, it can readily be seen that the number of individual coatings which might be made is infinite.

Several factors should be considered in selecting a coating for any specific application. Foremost are the need for coating and the type of service expected. Such factors as interior or exterior exposure, flexibility, hardness, and resistance to water, alkali or other chemicals must be considered. Cost is always of paramount importance and is often not studied too seriously. Cost per gallon is usually carefully considered, but is very often misleading while the more significant cost per finished article is all too often overlooked entirely.

The author discussed the mechanisms of film formation: (1) Solidification; (2) evaporation; (3) oxidation; and (4) polymerization. Also the properties of plasticizers, solvents, pigments, primers and other materials as well as factors such as surface preparation, application and film thickness which must be considered were dealt with.

Another interesting summary was "Painting of Nonferrous Metals" by G. T. Dunkley (Mech. World 653-657, 1948; Tech. Data Digest 13, 53, Aug. 1, 1948). The success of paint application on metal depends on the pretreatment of the surface, and the requirements vary widely for nonferrous metals. Instances were discussed in which special surface preparation and specially formulated paints are required. Electrochemical and chemical means of thickening the oxide film on aluminum and its alloys were described and a primer based on zinc chromate pigment was recommended.

Any normal finishing paint may be used over the primer, but paints containing copper or mercury compounds should be avoided. Methods of treating magnesium alloys were suggested for the elimination of alkali formation, which prevents adhesion of paint, on the surface. As magnesium alloys are very susceptible to corrosion, careful attention must be given to the pretreatment, choice of primer and finishing paint. Pretreatment of zinc is advisable, whether it is solid zinc, a zinc base alloy, or a zinc coating, especially new galvanized sheeting. Painting on cadmium, copper and its alloys, and lead and its alloys were also discussed.

TABLE I

Profit Survey of New York District Job Platers for 1947

Size of Shop	Owners and Officers Salaries, pct of Sales	Net Profit, pct of Sales
Under 25 men	12.2	7.9
25 to 50 men	10.2	6.7
Over 50 men	6.7	—3.2 (loss)

One of the most spectacular developments in this field is in silicone chemistry. In electrical insulation, silicones have done an outstanding job. Because of their unusual heat resistance, the insulation on motor windings does not undergo thermal breakdown, with the result that motors with silicone-covered windings can be operated at considerable overloads without damage to the insulation. Silicone elastomers have greater resistance to extremes of heat and cold, as well as to chemicals, than the natural or synthetic rubbers. In protective coating, silicone enamels have established new highs in resistance to elevated temperatures. White enamels are available which will withstand many hundreds of hours of exposure to temperatures in the vicinity of 500°F with little or no change in color or gloss.

In the article "Heat Resistant Silicone Finishes," by E. J. Bromstead and M. A. Glaser, General Electric Co. (Organic Finishing, March 1948), it is stated that the use of an aluminum silicone finish is indicated wherever long exposure periods at temperatures over 250°F are encountered. Some logical applications would be for oil burners, gas burners, mufflers, exhaust stacks, electrical equipment, aircraft parts and high temperature processing equipment.

Wrinkle finishes retain their popularity. In "Wrinkle Finishes—25 Control Points," (IRON AGE, Jan. 15, 1948), E. A. Zahn, General Electric Co., points out that to produce uniform wrinkle finishes consistently, careful control must be exercised over the many phases of the production process which may vary from time to time under normal operating conditions. The author isolated 25 specific factors, each of which can have a marked effect upon the finish regardless of its type or texture, and outlined methods for controlling these variables.

Strippable plastic coatings to protect surfaces are a young group of finishes, but very healthy. Most engineers in the metalworking industry realize the importance of protecting surface finishes during manufacturing operations and are aware of what a costly matter it is to bring a marred surface back to the required finish. Substantial savings in the cost of finishing deep drawn stainless steel parts have been reported by

a number of stamping plants through the use of a strippable plastic coating which remains on the sheet during the fabricating operations. This is only one of several applications that have been developed, as several types of strippable plastic coatings are available and have been successfully used in protecting polished surfaces before forming and also during machining, punching, welding and other fabricating operations.

Based on work carried out in the laboratories of the Bakelite Corp., the curing of phenolic resin baking coatings on metal by induction heating offers interesting possibilities. This method has been applied to the continuous coating and curing of thermosetting phenolic resins on pipe. The process involves the continuous passing of the pipe through a tank of the coating solution, and then through an electromagnetic field actuated by low-frequency alternating current. The pipe is almost instantly brought to the desired temperature and the coating is cured within several minutes.

Polythene has achieved a useful place in plating, being applied as a lining for plating and pickling tanks and as a coating on those portions of racks and jigs which are not to receive an electrodeposit.

"Adhesion of Enamel Finishes to Electroplated Cadmium Coatings" by E. E. Halls (Metallurgia 75-78, June 1948) reported on extensive laboratory tests performed on cadmium plated steel panels having various types of enamel finish applied after the cadmium had been given a variety of chemical surface treatments prior to enameling.

As stated above, the possibilities for new formulations of organic finishes are practically infinite and consequently, new ones appear constantly. Among those which seem to show promise at this time are water dispersions of synthetics, unplasticized vinyl lattices and new alkyds.

"Chromated Protein Films for the Protection of Metals," a paper by Abner Brenner, G. Riddell, and R. Seegmiller, National Bureau of Standards (J. Electrochem. Soc. 93, 55-62, March 1948), describes a process developed for protecting steel, zinc, aluminum and brass from corrosion. Casein, albumin or gelatin is applied to the metal surface by dipping. The film is then impregnated with chromate, which acts as an inhibitor of corrosion and hardens the film, either by adding the salt to the protein solution or by a separate immersion.

Generally speaking, in organic finishes, the trend in cleaning of metallic surfaces is toward the use of chemical methods. Combinations of steam and detergents discharged at high velocities against the soiled surface have proved successful. Cleaning and surface preparation methods are necessary, not only for preventing rust, but for improving the adhesion of the coating to the metallic surface, and in some cases, as a replacement for primers.

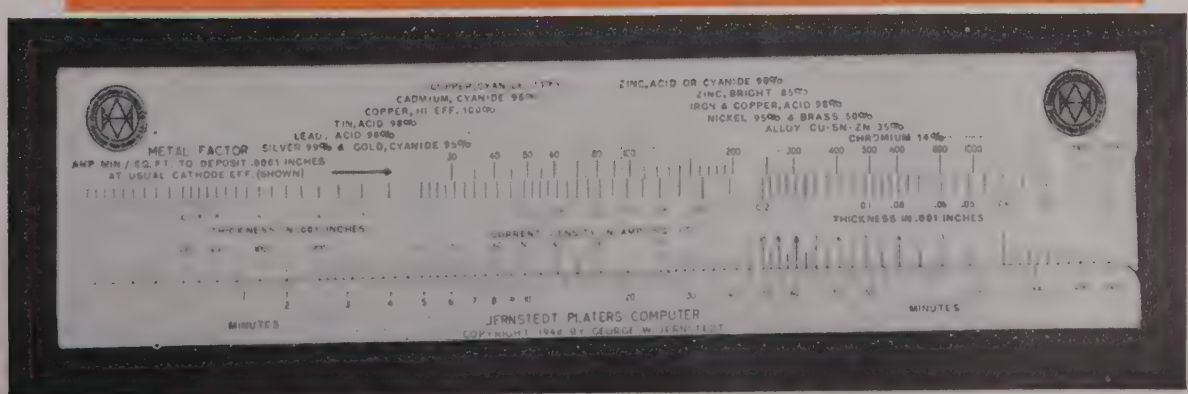
The use of conveyer systems has grown steadily, and in many instances the entire cycle of cleaning, surface preparation, spraying and baking is done automatically. Electrostatic spraying and detearing are being used to a greater extent. Drying and baking by infrared has been a major contribution to the finishing industry.

Conclusion

Finally, it may be said that the present general picture of the industry is bright. There are some shaded areas, to be sure, but not enough to cloud the sky more than enough to keep it from becoming unbearably hot. Metal finishing is moving steadily from an art to a science, as evidenced by the two outstanding new laboratories built this year by the Hanson-Van Winkle-Munning Co. and the Westinghouse Electric & Mfg. Co. It is spreading steadily into more and larger engineering and industrial applications and is, at the same time, holding its place firmly in decorative uses.

Last year, the present author closed this review with the statement that in spite of threats of extinction by stainless steel, plastics, and other materials, metal finishers would still be here for a year or two. He is pleased to report that this prediction, if no other, was correct. We are still here!

THE Jernstedt Computer, a slide rule for the rapid calculation of electroplating variables. Scales relate bath composition, current density, cathode efficiency, plate thickness and plating time.



Prices and Production

• • Presented herewith are prices and production for the metalworking industry for 1948. Basic figures from which these statistics are compiled each year appear in the weekly issues of THE IRON AGE.

By H. W. VAN CAMP
Associate Editor
THE IRON AGE

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United States Steel Ingot Production

Percent of Capacity

Source: American Iron and Steel Institute

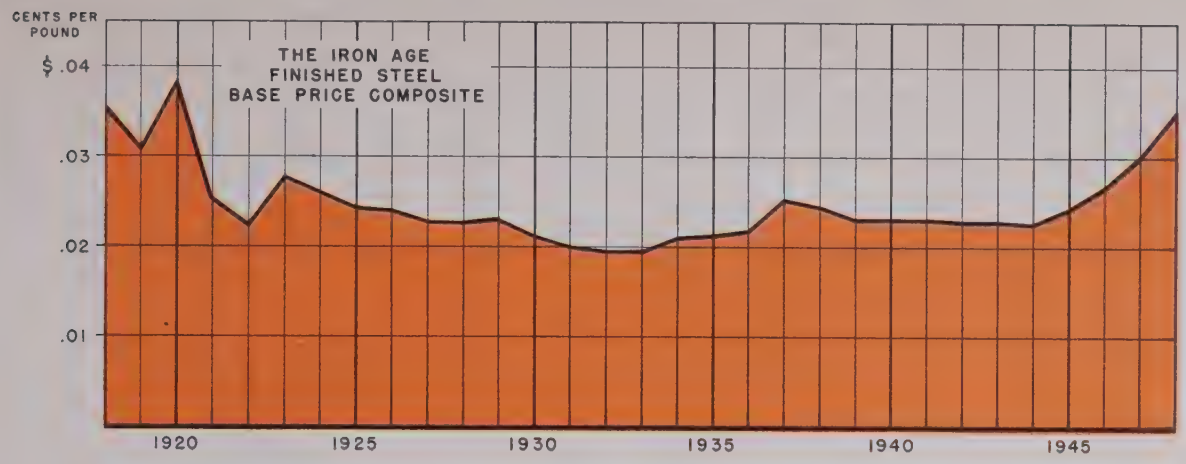
	1929	1931	1932	1933	1934	1936
January	86.56	44.59	25.88	17.76	34.32	52.46
February	92.21	50.07	26.62	20.75	42.10	54.61
March	97.48	54.21	24.98	15.68	48.09	57.54
April	98.32	50.71	22.67	24.26	52.10	70.09
May	101.68	45.29	19.61	34.51	58.42	69.68
June	97.38	39.00	16.42	46.24	54.29	70.85
July	93.51	33.58	14.09	55.45	25.65	67.71
August	95.00	30.47	14.76	50.00	23.74	72.22
September	90.14	28.39	17.89	41.29	22.57	74.16
October	87.22	28.22	18.94	36.40	25.46	78.26
November	69.94	29.17	18.57	27.43	28.58	77.05
December	55.96	23.15	15.04	31.48	33.83	76.53
Average	88.76	37.99	19.67	33.52	37.37	68.45

	1937	1938	1939	1940	1941	1942
January	81.32	29.14	52.69	83.40	96.90	94.50
February	84.26	31.59	54.93	70.00	96.60	95.90
March	89.93	33.67	56.52	63.50	99.70	98.20
April	90.24	33.70	50.97	61.20	97.60	97.70
May	88.79	30.26	48.51	71.80	98.70	98.10
June	74.47	23.33	53.57	84.50	98.20	96.30
July	78.37	33.25	52.60	83.00	93.40	94.50
August	83.71	42.63	62.45	89.50	95.70	95.40
September	76.19	46.03	72.68	90.60	96.40	96.40
October	53.25	52.19	89.52	96.10	99.00	100.00
November	38.16	61.74	93.46	96.60	98.30	97.80
December	25.34	52.72	85.91	94.10	98.10	96.60
Average	72.33	39.60	64.53	82.10	97.40	96.80

	1943	1944	1945	1946	1947	1948
January	96.80	95.70	88.80	49.60	93.20	93.60
February	98.50	97.00	90.80	19.80	91.90	93.00
March	100.00	98.60	95.00	83.30	94.40	95.30
April	99.30	98.80	92.80	77.50	93.90	80.40
May	98.40	97.10	91.80	52.20	94.70	94.80
June	94.80	94.10	87.10	74.40	92.90	93.80
July	96.20	94.30	86.30	84.90	85.10	88.70
August	98.30	94.10	70.70	86.90	90.20	93.10
September	100.70	94.00	76.30	86.90	90.80	96.10
October	101.20	95.60	69.00	89.00	97.70	99.90
November	98.60	94.30	78.90	85.40	96.50	100.50
December	94.20	92.60	74.80	73.90	95.40	97.59*
Average	98.10	95.50	83.50	72.50	93.00	93.90*

*Preliminary figure, subject to revision.

Finished Steel Composite Price Continued Upward Trend in 1948



Finished Steel Composite Price

(cents per pound)

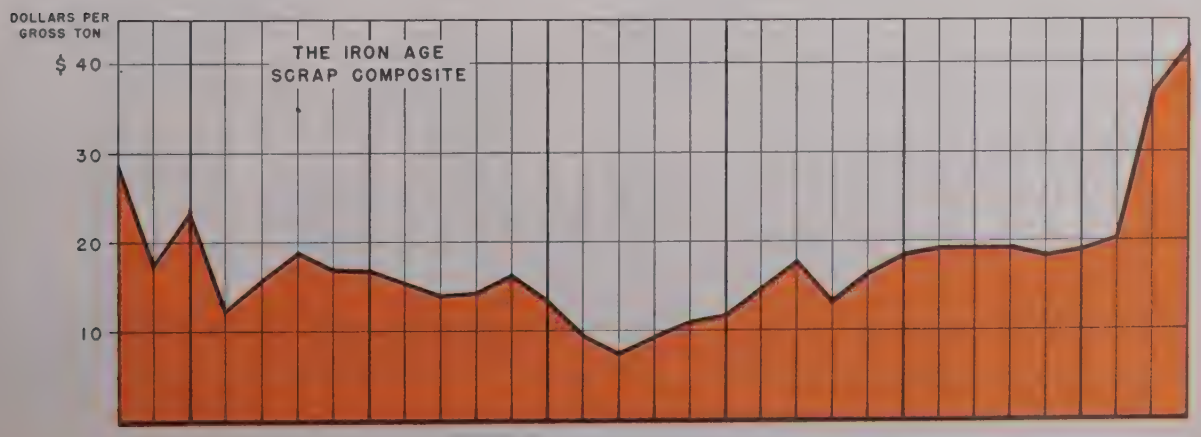
Source: THE IRON AGE

• • • **Weighted average of** THE IRON AGE quotations on shipments of the following steel items: Hot-rolled and cold-rolled strip and sheets, hot-rolled bars, plates, shapes, drawn wire, standard rails and black pipe. Prior to 1947, wire rod instead of drawn wire, was used to weight the index. The composite was revised in 1941 to obtain greater sensitivity in reflecting price changes. This revision was described in detail in issue of Aug. 28, 1941, p. 92. Prior to 1941, this index was computed on the basis of finished steel shipments in the 10-year period 1929-39. The three years, 1941, 1942 and 1943, are based on annual shipments for the year. Since 1944, the index has been based on quarterly shipments. Averages on the old basis for previous years were published in the annual statistical supplement, Jan. 4, 1940.

	1929	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
January	2.27758	2.32263	2.58414	2.35367	2.30467	2.30467	2.28249	2.29176	2.27235	2.38444	2.54490	2.86410	3.22566
February	2.27758	2.32263	2.58084	2.35367	2.30467	2.30457	2.28249	2.29176	2.27235	2.38444	2.54490	2.87118	3.24816
March	2.27623	2.53185	2.57754	2.35367	2.30467	2.30467	2.28249	2.29176	2.27235	2.38444	2.54490	2.87118	3.27585
April	2.30373	2.58414	2.57754	2.35367	2.26015	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239	3.28244
May	2.30723	2.58414	2.56939	2.30807	2.30467	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239	3.25419
June	2.31773	2.58414	2.51300	2.28297	2.30467	2.30467	2.28249	2.29176	2.30329	2.42471	2.73011	2.88239	3.25116
July	2.31213	2.58414	2.35944	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	2.90953	3.33659
August	2.29423	2.58414	2.35944	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	3.18676	3.75633
September	2.28225	2.58414	2.35655	2.28297	2.30467	2.30467	2.28249	2.29176	2.30837	2.44076	2.70711	3.18925	3.75628
October	2.26950	2.58414	2.31964	2.28297	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.70379	3.19541	3.75628*
November	2.26498	2.58414	2.35367	2.28837	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.70379	3.19541	3.75628*
December	2.27750	2.58414	2.35367	2.30467	2.30467	2.30467	2.28249	2.29176	2.21188	2.44104	2.73347	3.19541	3.75628*
Average	2.28839	2.53620	2.45874	2.31088	2.30096	2.30467	2.29249	2.29176	2.27298	2.42277	2.67395	3.01013	3.47129*

Preliminary figure, subject to revision

Rise in Scrap Steel Composite Price Slackened in 1948



Steel Ingot Production

Openhearth, Bessemer and Electric Ingots and Steel for Castings—Net Tons; U. S. Only

For data previous to 1922, see statistical supplement, THE IRON AGE, Jan. 4, 1940

Source: American Iron and Steel Institute

	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934
January	2,129,686	4,325,457	4,107,080	4,719,919	4,656,029	4,302,172	4,531,172	5,115,195	4,288,212	2,852,540	1,685,665	1,157,745	2,276,596
February	2,332,217	3,909,643	4,305,501	4,223,613	4,264,863	4,327,341	4,590,842	4,920,348	4,579,761	2,892,154	1,681,421	1,221,664	2,521,472
March	3,168,503	4,579,489	4,733,607	4,721,111	5,035,081	5,148,330	5,117,384	5,760,878	4,828,571	3,468,208	1,627,030	1,022,675	3,190,040
April	3,267,086	4,463,564	3,767,877	4,033,752	4,626,271	4,685,249	4,888,226	5,626,610	4,664,182	3,141,887	1,429,848	1,531,813	3,346,922
May	3,623,434	4,748,038	2,970,710	3,888,883	4,425,910	4,594,340	4,776,766	6,008,754	4,520,520	2,897,385	1,277,302	2,250,236	3,875,202
June	3,520,973	4,242,308	2,324,411	3,606,900	4,207,512	3,968,129	4,250,736	5,573,076	3,879,960	2,416,078	1,036,102	2,919,687	3,487,612
July	3,324,009	3,976,776	2,112,991	3,471,854	4,095,783	3,637,255	4,320,783	5,513,545	3,316,654	2,143,351	915,738	3,607,288	1,697,879
August	2,959,784	4,161,827	2,872,652	3,850,644	4,492,374	3,971,467	4,744,291	5,614,144	3,473,898	1,949,462	961,153	3,260,279	1,574,649
September	3,172,549	3,780,066	3,181,798	3,927,822	4,409,463	3,710,754	4,709,416	5,146,744	3,223,766	1,754,817	1,125,892	2,599,370	1,446,551
October	3,838,975	4,028,163	3,516,891	4,377 214	4,591,053	3,764,573	5,279,460	5,154,063	3,055,972	1,805,653	1,233,957	2,373,729	1,689,272
November	3,861,539	3,529,560	3,512,087	4,393,068	4,175,502	3,549,711	4,844,460	4,002,365	2,510,820	1,807,315	1,171,710	1,731,930	1,836,068
December	3,715,317	3,224,324	4,016,316	4,469,629	3,906,230	3,604,731	4,562,175	3,299,786	2,246,742	1,477,529	977.389	2,047,780	2,239,128
Total	38,914,072	48,969,215	41,421,921	49,684,409	52,886,071	49,264,052	56,615,711	61,735,509	44,589,058	28,606,379	15,123,207	25,724,196	29,181,329

	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
January	3,474,353	5,398,326	1,984,815	3,663,004	5,764,723	6,928,085	7,112,106	7,424,522	7,592,603	7,204,312	3,872,887	7,222,612	7,472,776
February	3,379,587	5,050,824	1,942,795	3,448,120	4,525,797	6,237,900	6,512,535	6,824,604	7,194,009	6,652,765	1,392,682	6,430,401	6,940,204
March	3,810,436	5,970,247	2,293,884	3,929,387	4,389,183	7,131,641	7,392,111	7,674,578	7,826,257	7,705,929	6,508,764	7,316,974	7,608,135
April	4,494,782	5,801,540	2,196,413	3,431,600	4,100,474	6,756,949	7,121,291	7,373,703	7,593,688	7,289,887	5,801,195	7,051,842	6,218,157
May	4,614,529	5,894,260	2,061,169	3,372,636	4,967,782	7,053,238	7,382,578	7,549,691	7,702,576	7,449,667	4,072,620	7,339,014	7,571,652
June	4,543,888	4,787,710	1,868,848	3,606,729	5,657,443	6,800,730	7,015,302	7,039,353	7,234,257	6,840,522	5,625,773	6,977,714	7,256,354
July	4,473,940	5,212,832	2,259,677	3,648,639	5,724,625	6,821,682	7,144,958	7,407,876	7,948,387	6,985,571	6,618,683	6,578,685	7,067,024
August	4,782,442	5,580,683	2,903,805	4,341,726	6,186,383	7,000,957	7,227,655	7,586,464	7,498,913	5,735,317	6,924,522	6,991,152	7,437,608
September	4,744,841	4,907,592	3,029,736	4,881,601	6,056,246	6,819,706	7,057,519	7,514,339	7,235,111	5,982,475	6,555,566	6,797,457	7,415,610
October	5,182,430	3,881,819	3,554,912	6,223,126	6,644,542	7,242,683	7,579,514	7,814,117	7,620,885	5,596,776	6,951,742	7,570,152	7,973,416
November	4,941,014	2,464,793	4,072,676	6,292,322	6,469,107	6,969,987	7,179,812	7,371,975	7,278,719	6,200,466	6,457,771	7,242,427	7,763,216
December	5,056,843	1,685,273	3,583,253	5,958,893	6,495,357	7,163,999	7,304,540	7,255,144	7,336,170	6,057,937	5,760,501	7,375,641	7,762,152*
Total	53,449,085	56,635,899	31,751,983	52,797,783	66,981,662	82,927,557	86,029,921	88,836,366	89,641,575	79,701,624	66,602,706	84,894,071	88,500,000*

Preliminary figure, subject to revision

Pig Iron Production

Includes ferroalloys made in blast furnaces, but excludes charcoal iron; U. S. Production only
(thousands of net tons)

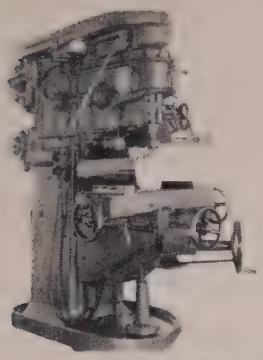
Source: 1901 *to* 1942, THE IRON AGE; *October* 1942 *to* 1948, *AISI*

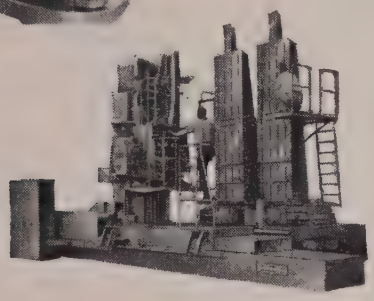
	Jan.	Feb.	Mar.	April	May	June	First Half	July	Aug.	Sept.	Oct.	Nov.	Dec.	Second Half	Year
1901	1301	1270	1433	1408	1500	1476	8,388	1523	1496	1456	1548	1526	1418	8,967	17,355
1910	2922	2685	2932	2782	2677	2537	16,535	2407	2360	2303	2344	2139	1991	13,544	30,079
1920	3377	3337	3781	3068	3344	3409	20,316	3435	3525	3504	3688	3287	3029	20,468	40,784
1921	2705	2169	1788	1336	1368	1193	10,559	969	1069	1104	1396	1585	1847	7,970	18,529
1922	1842	1826	2280	2321	2583	2644	13,496	2694	2034	2278	2956	3191	3457	16,610	30,106
1923	3617	3353	3947	3976	4332	4117	23,342	4119	3864	3501	3527	3241	3272	21,524	44,866
1924	3382	3441	3883	3622	2929	2269	19,526	1999	2114	2299	2774	2811	3318	15,315	34,841
1925	3774	3600	3992	3650	3283	2995	21,294	2984	3030	3052	3386	3386	3640	19,478	40,772
1926	3714	3274	3855	3864	3900	3623	22,230	3610	3586	3512	3734	3626	3461	21,529	43,759
1927	3477	3294	3901	3832	3798	3461	21,763	3305	3300	3108	3118	2966	3020	18,817	40,580
1928	3214	3248	3585	3567	3678	3452	20,744	3441	3514	3429	3779	3698	3774	21,635	42,379
1929	3855	3591	4160	4102	4366	4163	24,237	4239	4218	3918	4019	3563	3177	23,133	47,360
1930	3166	3180	3636	3564	3620	3286	20,452	2956	2827	2550	2425	2092	1866	14,716	35,168
1931	1920	1912	2276	2261	2233	1836	12,438	1639	1435	1309	1314	1235	1098	8,030	20,468
1932	1089	1080	1084	954	877	704	5,788	640	582	663	721	707	612	3,925	9,713
1933	637	621	607	699	993	1417	4,974	2007	2053	1705	1519	1215	1323	9,822	14,796
1934	1361	1416	1813	1934	2288	2162	10,974	1372	1181	1006	1065	1072	1151	6,847	17,821
1935	1654	1802	1983	1863	1934	1739	10,975	1702	1972	1990	2215	2315	2360	12,554	23,529
1936	2269	2042	2285	2693	2966	2896	15,151	2905	3037	3058	3351	3301	3489	19,141	34,292
1937	3597	3359	3875	3799	3961	3481	22,072	3919	4039	3819	3239	2248	1669	18,933	41,005
1938	1601	1454	1627	1541	1406	1189	8,818	1346	1673	1882	2298	2543	2476	12,218	21,036
1939	2436	2307	2682	2303	1924	2373	14,025	2639	2979	3224	4063	4167	4220	21,292	35,317
1940	4032	3311	3270	3137	3514	3819	21,083	4054	4238	4177	4446	4403	4548	25,866	46,949
1941	4664	4198	4704	4334	4600	4553	27,053	4771	4791	4717	4856	4703	5012	28,850	55,903
1942	4971	4500	5055	4896	5073	4935	29,430	5051	5009	4937	5237	4966	5201	30,552	59,982
1943	5137	4766	5314	5035	5178	4836	30,343	5023	5316	5226	5324	5096	5213	31,434	61,777
1944	5283	5091	5442	5251	5351	5064	31,482	5157	5210	4988	5200	4904	4998	30,457	61,939
1945	4945	4563	5228	4786	5016	4605	29,142	4801	4249	4227	3388	4026	4323	25,025	54,167
1946	2645	1148	4424	3814	2275	3682	17,807	4705	4898	4687	4815	4435	3992	27,572	45,379
1947	5071	4550	5123	4830	5081	4810	29,480	4585	4917	4801	5228	5015	5177	29,723	59,209
1948	5195	4838	5019	3840	5077	4990	28,961	4899	5254	5207	5520	5480*	5400*	31,760*	60,721*

Preliminary figure, subject to revision

(CONTINUED ON PAGE 326)

Now Pratt & Whitney supplies everything you need to make any kind of die or mold





From a single source — Pratt & Whitney — flows everything you need to make any kind of die or mold of any type or size. The fact that it's *Pratt & Whitney* means you get *precision equipment* of right design produced by skilled craftsmen working to a single high standard of precision and quality. And the fact that Pratt & Whitney is the *single source* means you get *unified responsibility* for the performance of machines and equipment, better results at lower cost, and no buck-passing when you need help. Write for detailed literature. No obligation, of course.

1. DIE SINKERS — Plain and Universal — for making original dies and molds by conventional methods, from drawings or prints.
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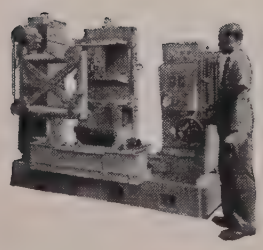
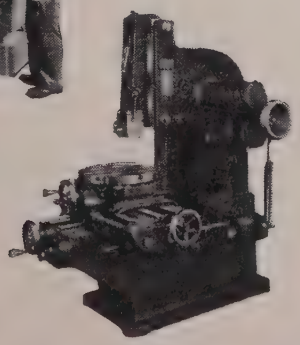
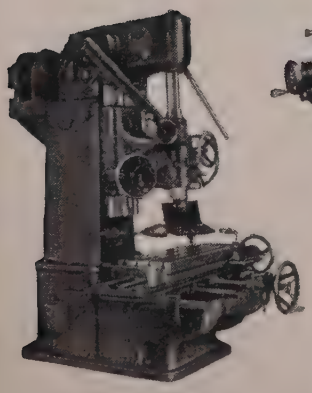
5. JIG BORERS, for precision-boring of punch and die sets and intricate molds and dies, of all kinds.
6. VERTICAL SURFACE GRINDERS for rough or finish grinding of almost any material. Provides exactly the right table speed for each job. Available in several sizes.
7. KELLERFLEX MACHINES — flexible shaft equipment for efficient finishing of dies and molds. Both multi-speed and direct drive types, in 14 models.







NOT ILLUSTRATED: JIG GRINDER, for relocating and finish-grinding straight or tapered holes to "tenths," in hardened steel. KELLER CUTTER AND RADIUS GRINDER: sharpens die-sinking and Keller cutters, shapes Keller tracer points. VERTICAL DIE GRINDER: prepares new die block surfaces prior to machining, sharpens dull dies, reconditions die block faces before resinking operations. BURS (rotary files); used in Kellerflex and similar machines, for finishing jobs. P&W furnishes hundreds of styles, shapes, sizes in both high-speed steel and carbide, plus grinding and polishing wheels, etc. SMALL TOOLS: including die-sinking cutters, Keller cutters and tracer points, drills, reamers, counterbores, end mills for jig borers. P&W GAGES: entire range of cylindrical gages, thread gages, snap gages, precision gage blocks, and basic measuring equipment.

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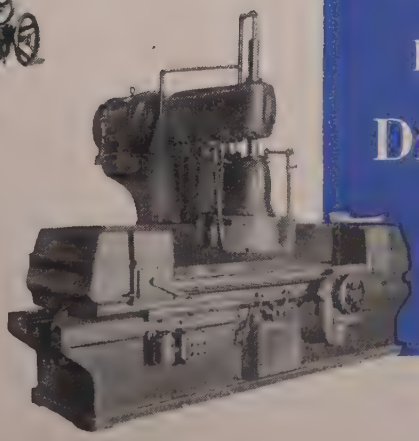

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• Steel suppliers see break in auto market during '49 but car makers look forward with confidence to a record-making year . . . 1948 production total is just 76,000 short of a new record.

DETROIT—The year 1949 will be a year of decision for both the automobile industry and the steel industry.

The next 12 months will undoubtedly tell a lot about whether or not the steel industry was justified in declining to expand its facilities in order to meet the automakers' insistent demands for more steel.

If the automobile market breaks during 1949—or becomes seriously sluggish—the steel industry can be relied upon to stand up and yell, "We told you so." If, on the other hand, the auto industry is able to do a superb job of selling, it may leap over the present price obstacles and move at least as many cars as it did during 1948. If this happens, many Detroiters will insist that the steel industry is still selling automobiles short.

At the moment, Detroit is separated into two camps with sharply divided opinions about the market for new cars. If one insists that the auto market is going to be caught up to a point where May or June will see the end of the steel shortages, he is quickly tagged as the advocate of the steel industry. If he sees the auto industry continuing at its present pace, held back only by the lack of steel, he is challenged as the champion of the auto industry and the naive victim of its propaganda.

There are some aspects of the situation on which there is fair agreement. It is generally admitted, for example, that with the exception of Cadillac most cars selling at $2500 or more are piling up in dealers' establishments. The auto industry says this is temporary and seasonal. These cars will be moved readily, it asserts. A little pressure by the car-makers, a little more generous allowance on trade-ins and the public will take 'em away. Didn't K-F move more than 20,000 cars in a few weeks last year when they began to pile up?

The steel advocates, on the other hand, don't see the car dealers changing their stripes so quickly. A car dealer will hang on to the high profit dollar to the bitter end, say the industry's critics. Besides, car dealers have picked up so much fat, so much arrogance and so much dollar worship during 4 years of order-taking, they have completely forgotten how to sell—if they ever really knew how.

The argument can be continued endlessly. Markets break downward much faster than they move upward. In a rising price market, the buyer supplies all the umph; in a falling price market the buyer supplies only large quantities of sales resistance and the dealer has to do all the work.

ONE thing seems certain enough. The automakers will *try* to produce as many cars as possible during 1949. They'll be happy indeed if the steel situation clears itself during the year and puts an end to costly conversion deals and endless steel chasing. The industry has no question in its own mind that it can move all the cars it will make during 1949.

The doubters, the scoffers and the detractors will be ignored. The industry will go ahead in 1949 with a will to set an all-time production record. Auto executives think this can be done, despite the fact that a sizable crop of unbelievers appears to be springing up. At least, the car makers will give their own ideas a try during 1949.

It may indeed be some time before any car maker is going to admit he's over-produced or over-optimistic or over-anxious about anything. And the steelmakers will remain equally adamant. Only the march of events will tell the true story. And, as some observers see it, either Phillip Murray and Walter Reuther (or both) may step in and take the ball away from either side during the year to bring about a different result that neither the auto industry nor the steel industry can be held entirely accountable for.

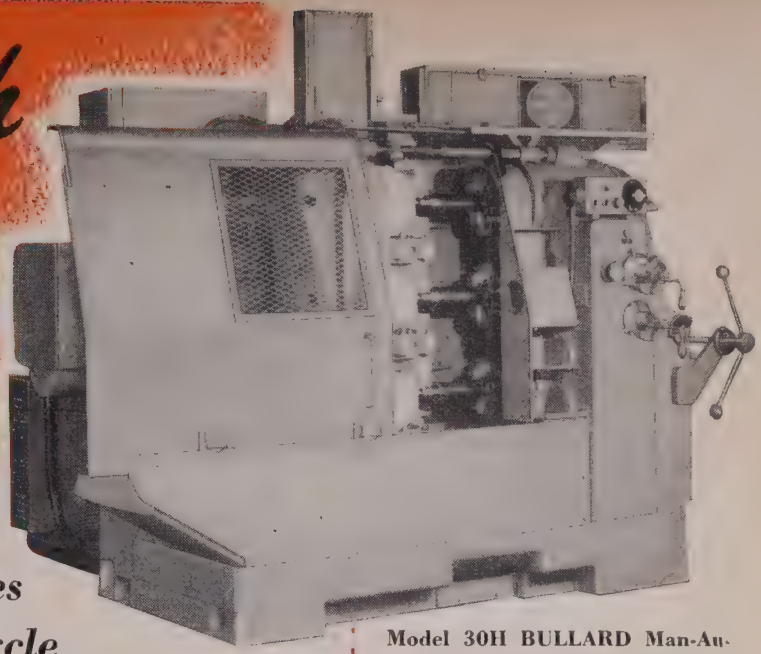
MAYBE Frank Rising, has made a point in his publication, "Memo to Management" which is mailed every month to members of the Automotive & Aviation Parts Manufacturers Assn. What business needs, Mr. Rising contends, is more men who can stand up on their feet and speak in plain, ordinary words to plain ordinary people.

According to Mr. Rising, it is nearly always possible to get competent union spokesmen to participate in forum meetings, but one always has a terrible time trying to get anyone from management.

The place where business has fallen down hardest is right at home, Mr. Rising argues. The place where management needs a spokesman is in the community. It should be evident by now, he warns, that oft repeated advertisements about the blessing of the American way of life contrasted with life in Russia and elaborate booklets and radio programs about the free enterprise system are not enough.

Trade associations are good at collecting statistics, holding meetings, and acting as funnels to and from government, he continues. At the same time, business has

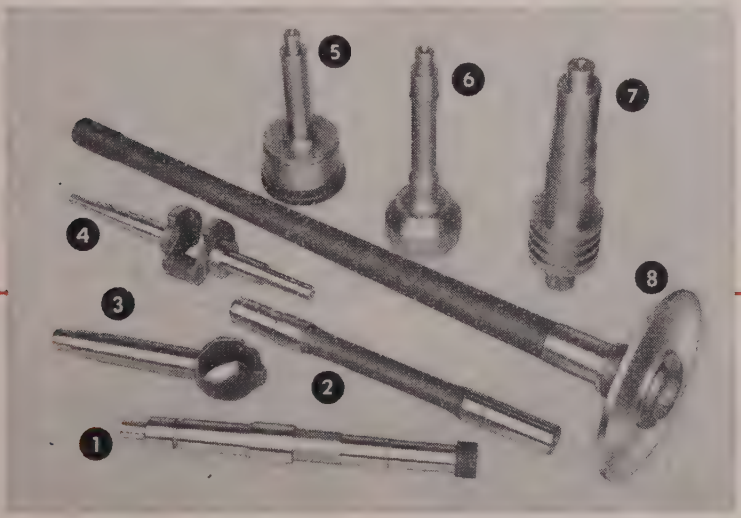
It's 3 for 1 with BULLARD MODEL 30H HORIZONTAL LATHE



Model 30H Man-Au-Trol Horizontal Lathe Produces 3 Identical Pieces Per Cycle

Reports are now coming in from owners of BULLARD Man-Au-Trol Horizontal Lathes proving that this machine's unique "3 for 1" method really pays off in lower production costs. See the accompanying chart for some actual figures.

Model 30H BULLARD Man-Au-Trol Horizontal Lathe triples production on between-center shaft turning work by machining 3 finished pieces per cycle with its 3 identically tooled spindles. Simplified tooling for rough and finished cuts also reduces tooling costs. Multiple-tool blocks are provided when needed for grooving, recessing, chamfering, angle-turning and other such operations.



These 8 Production Reports May Suggest Big Savings For YOU

Number	Part	Material	3 Pcs. Floor to Floor Time	Time per Piece
1	Third Motion Shaft	Steel Forging	2.21 min.	44 sec.
2	Inner Axle Shaft	SAE 4140	1.c2 min.	32 sec.
3	Sector Shaft	SAE 5132	.8 min.	15 sec.
4	Crankshaft	Steel Casting	2.25 min.	45 sec.
5	Overdrive Main Shaft	SAE 4620	1.96 min.	39 sec.
6	Outer Race Bell	SAE 4620	2.0 min.	40 sec.
7	Counter Shaft	SAE 4320	1st chg. 1.78 min. 2nd chg. 1.63 min.	36 sec.—1st chuck 32.6 sec.—2nd chuck
8	Rear Axle Shaft	SAE 8630H Forge	2.30 min.	46 sec.

WANT *ALL* THE FACTS?

Here's a Lathe with unique "3 for 1" productivity, right-handed operating convenience, Man-Au-Trol versatility, (manual or automatic operation) and startling performance.

In the interest of lower manufacturing costs, make a study of the Model 30H BULLARD Man-Au-Trol Horizontal Lathe. Write today for booklet and time studies on your work. THE BULLARD COMPANY, Bridgeport 2, Connecticut.

16 MM SOUND MOTION PICTURE

available for Group Showing by writing for scheduling. When writing advise your preferred date.

USE BULLARD MACHINES FOR PRODUCTION ECONOMY

nobody right now to represent it before schools, churches, colleges, civic groups, women's clubs and social agencies.

Mr. Rising suggests that the business executive probably needs to have a man on his own staff who can be ready to do a good job in speaking for the company—anytime, at any place, on request.

The battle between our competitive, personal-freedom kind of society and some sort of "Americanized" socialism isn't lost—but it can be lost on the community meeting front, he warns. Management is both resourceful and able. Its failure to recognize the importance of personal participation and oral persuasion in opinion-forming meetings can be and should be corrected, he concludes.

Despite the steel shortage, a few strikes, government allocations and the fact that it produced three times as many replacement parts as ever before, automobile industry output for the year 1948 fell only 76,000 units short of the all-time record high of 1929.

The Automobile Manufacturers Assn. estimates that 1948 production will reach 5,282,000 cars, trucks and buses. This will be the second time in history that the industry has made more than 5 million units in a single year. Total passenger cars built will reach 3,911,000 the third highest annual car output in the industry.

Exports of motor vehicles have been a disappointment, reaching the lowest point for a peacetime year since 1925. Meanwhile, imports of new cars have shown a sharp increase, the agency said.

The wholesale value of replacement parts produced during 1948 was 10 pct higher than 1947 and four times the prewar total.

During the year 1948 automotive employment and payrolls established new records.

•

Vehicle Registration Up

Detroit

• • • **With the completion** of the 9 millionth car since production was resumed following the war, total vehicle registrations in the United States reached 33,351,000 during 1948. This is an increase of 8 pct over 1947 and about 12½ pct higher than 1941.

Vehicle registrations have increased sharply in several parts of the country. Registrations in Arizona have increased 36.3 pct since 1941. Florida registrations are up 34.5 pct. The numerical increase in California is 636,000 passenger cars, followed by Texas with a gain of 324,000 automobiles.

Average age of passenger cars on the road today is 8.7 years compared with the prewar average of 5½ years.

Nearly 11 million cars on the highways were built between 1939 and 1942 while more than 14 million were produced prior to 1939, according to ANA.

While earnings figures are not yet available, Hudson Motor Car Co. is enjoying one of the best years in its 40-year history, according to A. E. Barit, president and general manager.

Sales volume was the largest in the company's history, Mr. Barit said. Employment has increased 65 pct during 1948 when 12,000 new jobs were created. Operations are on a multiple-shift basis, it was disclosed.

During the past year Hudson added 200,000 additional sq ft of manufacturing space through the acquisition of its Harper plant. Large expenditures for tooling were made for the new convertible and improvements in the Hudson "step-down" model cars.

At the end of the year Hudson's employment stood at approximately 30,000.

•

High Compression Ratio

Detroit

• • • **The 1949 Crosley cars** will use a compression ratio of 7.8 to 1, according to Powel Crosley, Jr., president of the company. This is the highest compression ratio in the industry.

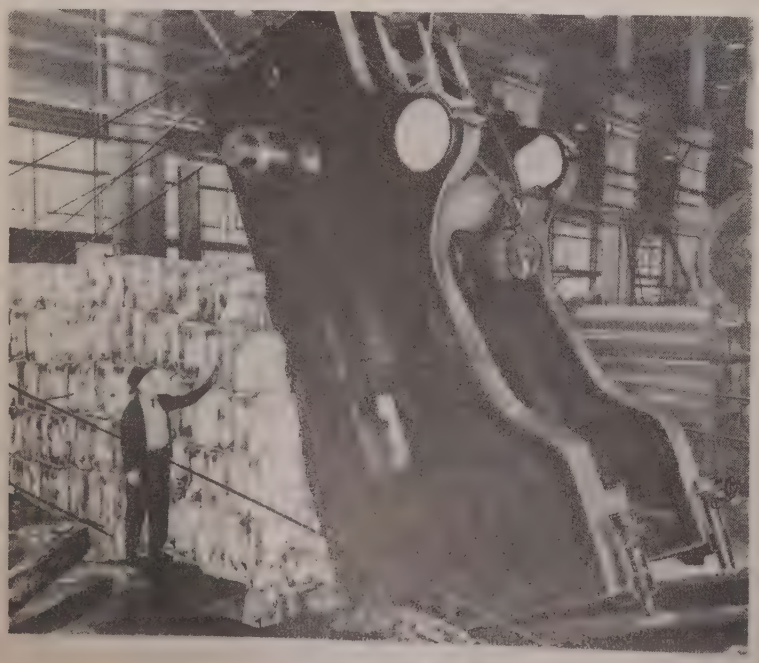
Crosley engineers say the 1949 cars will add at least 10 pct to the cars present range of 35 to 50 miles per gallon of gasoline.

Extensive changes in hood and grille treatment, housing for the fender lines have been made in front headlights and extension of the 1949 Crosley models.

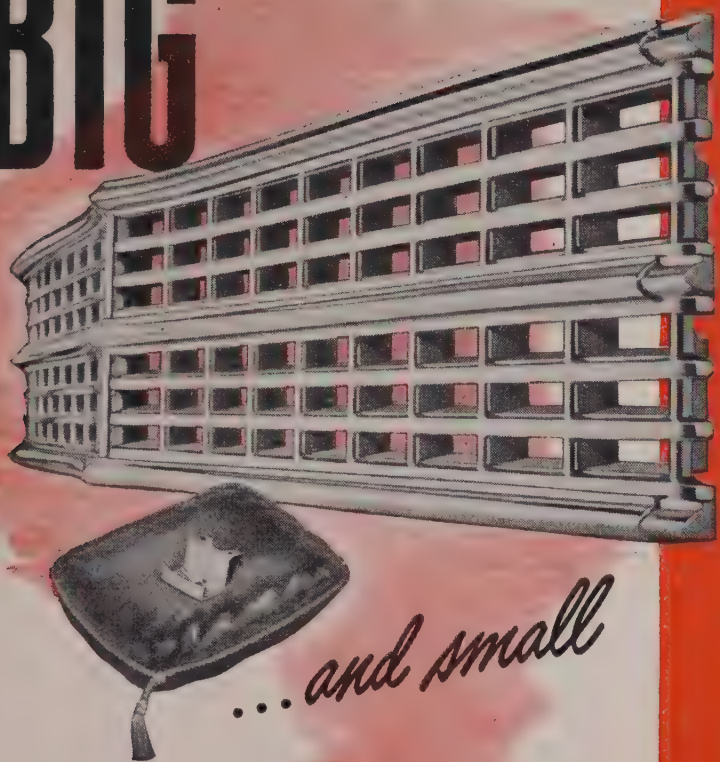
The new Station Wagon has a larger body and removable rear seats. The luggage compartment on all models has been increased inside.

New factory list prices f.o.b. Marion, Ind., are: Deluxe Sedan, $899; Club Convertible, $899; Station Wagon $929; Panel Delivery, $879; Pickup Truck, $849.

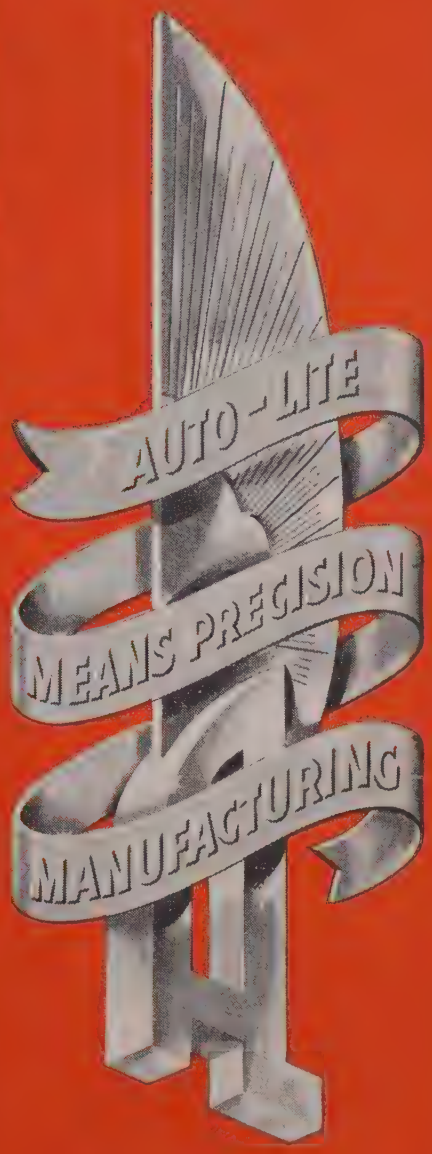
THE ICE AGE: *They had to lay this 275,000 lb press flat on the ground at the Chevrolet plant in Muncie, Ind. before it could be shipped. Instead of using heavy duty cranes to do the job, workmen placed 350 cakes of ice behind the press, let them freeze solid and then tilted the press against its surface. As the ice melted the press sank slowly to a horizontal position.*



BIG



...and small



• From small precision-made parts to massive radiator grilles in glittering chrome, Auto-Lite's die casting research and experience is helping industry develop a wide variety of new products. Through its "Controlled Metals" inspection processes, plus the finest production equipment and methods, Auto-Lite is able to assure manufacturers beauty, strength and accuracy on every type of job.

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CASTING, MACHINING, FINISHING
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DIE CASTING *by Auto-Lite*

Tune in "Suspense!" Radio Adventure at its greatest
Thursdays 9:00 P.M.—E.S.T. on CBS

Washington . . .

EUGENE J. HARDY

• The inexorable grinding of the mills of government tends to daze the onlooker, even Iron Age editors—as proved by this column.

WASHINGTON—'Tis the week after New Year's and all through the nation the viewpoints are varied—some fear, some elation.

Democrats in! Republicans out! On Capitol Hill there's tumult and shout.

The Congress—80th—is a thing of the past; the 81st's in to make itself fast.

The voters, it feels, a mandate have given—Controls! Allocations! New standards of livin'!

Committees are gathering, legislation to chart; there's plenty to do—but where should they start?

But meantime, the newsmen are tearing their hair; seeking hints of events that are soon to be here.

And each legislator and agency head to the simplest inquiries shout loudly "Drop dead!"

"You know that The Boss wants to tell it himself when he takes his inaugural speech from the shelf.

"As for us, it's evident we'd better not talk, so why don't you go and take a long walk

"Till he tells it to Congress." So that's how it be—we don't make the news, but report what we see.

So, with lack of news of important meetings, we'll use this space to extend our greetings.

* * *

THE season's tidings! Joy and cheer! To the metal trade that's survived a year.

Of legislative shouts and sighs, and rumbling threats to nationalize.

Ring the welkin! Horns, unmute! Let's drink a toast to the Institute;

To Harry Truman and Mrs. Bess; to Philip Murray, and Wolcott, Jess.

To Dr. Nourse, White House adviser; Joe O'Mahoney and Henry Kaiser.

To those who lent a shoulder to cry on—Fairless, White and Catherine Guyon.

To H. B. McCoy the best of cheer; may he give us more tin cans for beer.

To Walter Janssen, that metals cyclopedia; good friend of trade writers and all other media.

Also Ed Barringer and his battles for scrap; may the Germans soon dump it all in his lap.

For the Bureau of Mines, long lacking a chief; may '49 see John L. turn o'er a new leaf.

To Bill Simon as well, delivered price crusader; may he be rewarded, sooner or later.

To Senator Flanders, Kingsland Macy; Ed Martin, too, for hearings racy.

To Lowell Mason, may he never cease; to the WAA—may it rest in peace.

To the Army and Navy and Air Force, too; may they be really united ere the year is through.

To the Munitions Board that maps defense; and the OIC, those hard-pressed gents.

To the State Dept. and the deals it's made; to the ITO and international trade.

To the ECA and its Hoffman, Paul; to export quotas, both large and small.

We lift our cup to the FTC; and basing points now dead by decree.

To Louis Bean, and Charlie Sawyer; each lobbyist, each lowly lawyer.

To Colonel Johnson and his ODT; each alphabetical agency.

May steel capacity soon be long, despite Jim Murray's dance and song.

So lift the voice, give with a cheer, may '49 be a grand New Year.

•

Navy Experimenting With Lightweight Equipment

Washington

• • • **The Department** of the Navy is experimenting with lightweight engineering equipment capable of being moved by air transport.

Aluminum and other light metals are being tried out in place of steel in at least 4 different types of equipment by the Navy's Bureau of Yards and Docks. The Navy says the new program is being carried out "in view of the need for highly mobile equipment in modern warfare."

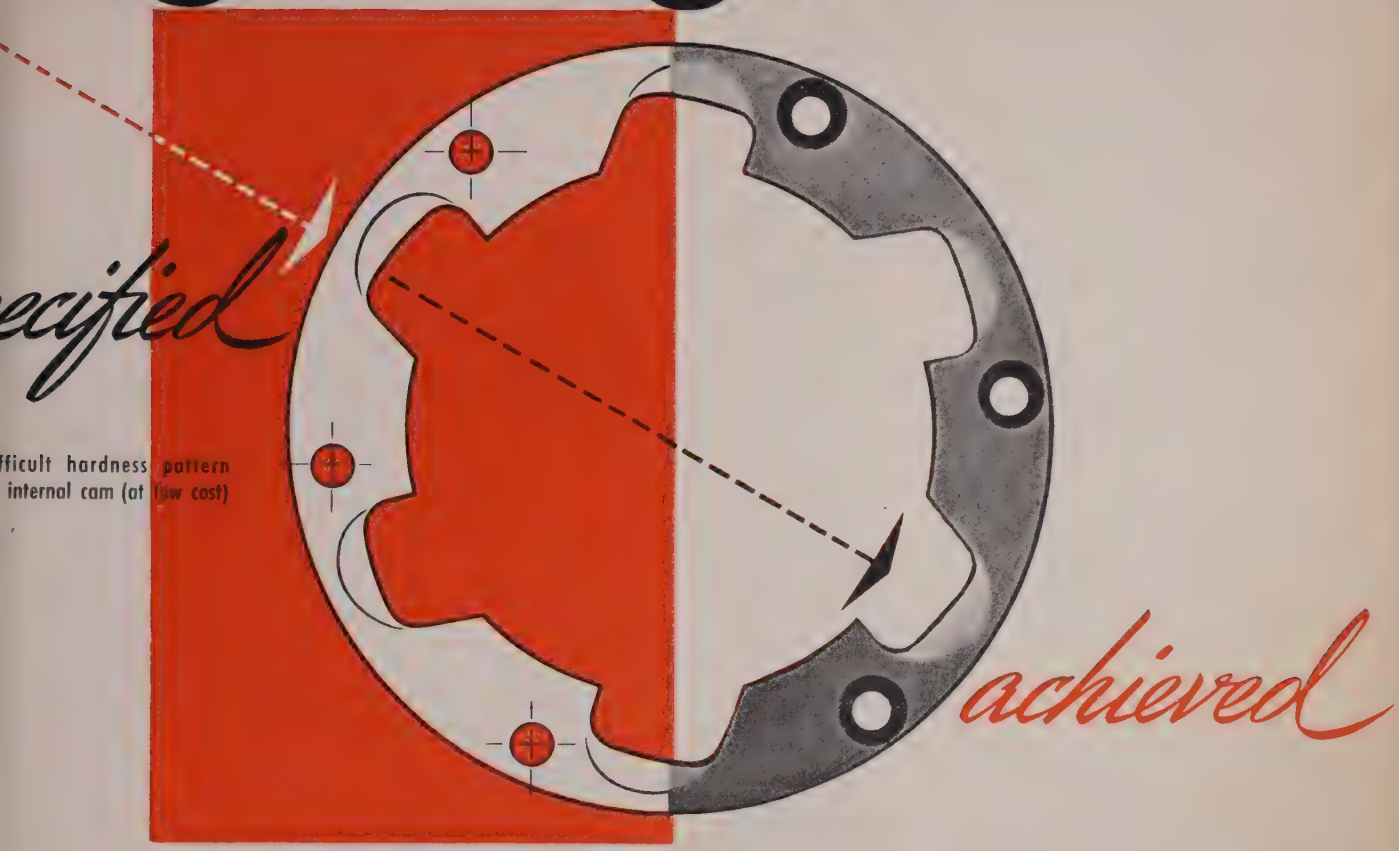
The lighter metals are used only where they do not impede the performance or wearing ability of the equipment, according to Navy engineers.

The equipment now under development includes:

(1) *A diesel-driven 60-kilowatt generator set,* which weighs about 3000 lb in comparison with the standard set which weighs from 5000 to 6000 lb. It is now being tested at the Naval Construction Battalion Test Center, Port Hueneme, Calif.

(2) *A six-by-six foot motor grader,* which weighs about 17,000 lb in comparison with the four-by-four foot wartime commercial grader weighing approximately 22,000 lb. It is being built for the Navy by the Austin-Western Road Machinery Co. of Aurora, Ill.

(3) *An air-cooled 260-CFM air compressor,* expected to weigh about 2000 lb in comparison with the water-cooled 210-CFM air compressor machine



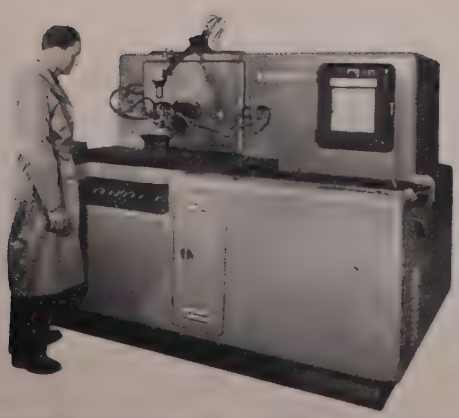
. . . by **flamatic** selective surface hardening

. . . with electronic temperature control. Rejects cut from 25% to nothing. Bottleneck broken, production trebled. Specified hardness values and patterns produced uniformly. 187 parts processed per hour.

That sums up Flamatic's remarkable performance in selective surface hardening internal lobes of the cams for a new automatic torque converter transmission. An engineered-to-the-job flame head with six ports heats the desired areas with high speed to within plus or minus 5°F of preset value – using exclusive Flamatic electronic temperature control. Operator simply loads parts, pushes button to start heating cycle; part is deposited in oil quench and then automatically delivered from quench on a conveyor.

Gears, cams, and similar parts up to 18" OD, and shafts up to 30" long have been successfully precision hardened on Flamatic. You can virtually **blueprint in advance** the hardness patterns and **duplicate the desired results in one part or many thousands.**

Write for informative booklet of case histories: Publication No. M-1658.



flamatic

THE CINCINNATI MILLING MACHINE CO.

Cincinnati 9, Ohio, U. S. A. • CINCINNATI

used during World War II which weighed from 5000 to 7000 lb. It is being developed in cooperation with the U. S. Air Force and other Navy bureaus which use air compressors for different purposes.

(4) *A portable welding unit,* expected to weigh half as much as the 2000-2500-lb model previously used by the Bureau of Yards and Docks. Tests are being conducted at Port Hueneme on two 150-ampere gas-driven units, which could be used singly or operated in parallel to duplicate the 300 amperes of the previously used models.

ICC Authorizes Freight Rise Averaging 5.17 Pct

Washington

• • • **Railroad freight rates** will be increased an average 5.17 pct next week. All types of shipments in every part of the country will be affected.

The new and higher rates were authorized by the Interstate Commerce Commission on December 29 as a result of the railroads' application for temporary rate hikes averaging 8 pct. The roads' application for permanent rate increases averaging 13 pct still is pending before ICC.

Rates on iron ore, coal and coke will be raised at the same time the general rate hikes go into effect.

ICC estimates that the new rates will return approximately $425,000,000 in additional revenue to the railroads. The percentage increases by territory are as follows:

Within and between Eastern and Southern Territories, 6 pct.

Within Zone 1 of Western Trunk Line Territory, 5 pct.

Within Western Territory other than Zone 1, 4 pct.

Interterritorial movements except those between Eastern and Southern Territories, 5 pct.

ICC denied the railroads' petition for specific cents-per-ton increases on iron ore, coal, and coke, and authorized only application of the general percentage increases. The percentage increases will amount to slightly less than the specific increases asked by the railroads, which were 30 cents per net ton or 34 cents per gross ton on coal and coke and 25 cents per ton net or gross as rated, on iron ore.

The railroads' proposal as to iron ore did not cover the line haul rates on ore moving from the Mesabi range to upper Great Lakes ports. ICC also exempted those movements from the authority it granted for application of the general percentage increases to iron ore rates.

Among the charges exempted from the proposed increases by the railroads are handling and wharfage charges at South Atlantic and Gulf of Mexico ports, charges for handling iron ore at the upper Great Lakes ports, and for storing it at the lower lake ports. However, handling charges on ore at lower lake ports will go up 6 pct. In addition, there will be no increases in demurrage charges or in allowances paid by railroads for drayage or other services performed by shippers or receivers of freight.

ICC estimates that the total cumulated increases in freight revenue since June 30, 1946, including the new authorizations, will be at the rate of about $2,900,000,000 per annum, or approximately an over-all increase of 52 pct of the rates effective at that date. ICC also observed that the eastern carriers have been relatively the greatest beneficiaries in this increase, as they are in the new rate authorizations.

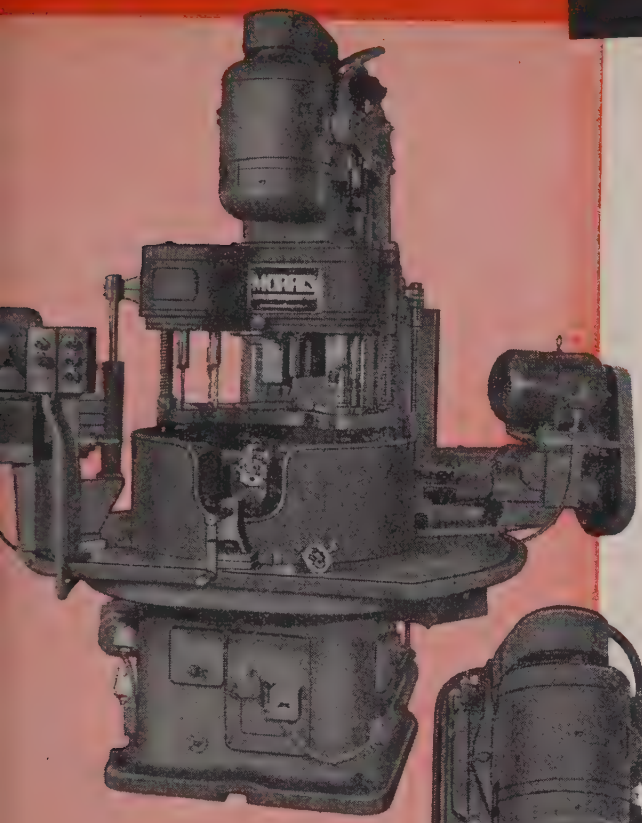
Hearings on the railroads' application for a permanent rate increase will be held in each of the four rate territories "as speedily as possible," ICC said, adding that "testimony may be received as to the specific requests of the railroads and other carriers, and a more full opportunity will be afforded to protestants to make their showing than could be given upon the recent hearing of the motion for a temporary and interim increase."

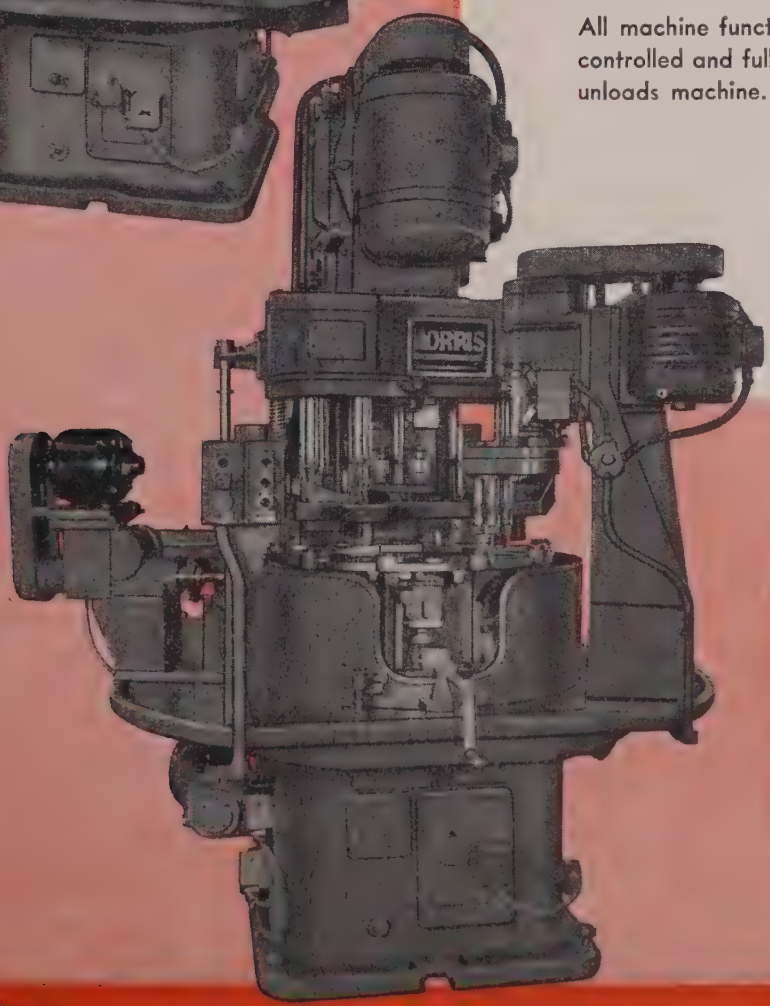
Water carriers and freight forwarders who intervened in the current rate proceeding (Ex Parte 168) are now authorized by ICC to post new rate schedules similar to those authorized for the railroads.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

PULLING FOR
HIGH PRODUCTION—

MORRIS MOR-SPEED
Production Machines





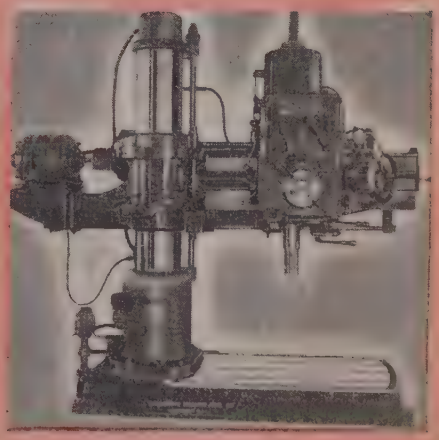
● These machines were designed and built for rough and finished machine operations on housings for automobile pumps.

The one at the left is a Morris Hydraulic Vertical 10-Station Automatic Machine for drilling, reaming, chamfering and tapping operations. It has twelve vertical drilling spindles—four vertical tap spindles and one horizontal drill spindle. Ten hand clamp holding fixtures are mounted on the indexing table.

The machine below is a Hydraulic Vertical 6-Station Automatic Indexing Machine for drilling, reaming, counterboring and spotfacing operations. It is equipped with four vertical drill spindles, two vertical reaming spindles and one vertical spotfacing spindle. Six hand clamp holding fixtures are arranged to hold the work.

All machine functions on both machines are hydraulically controlled and fully automatic—operator merely loads and unloads machine.

When your work requires multiple operations and high productivity consult Morris; they have the experience — engineering "know how" — and facilities to design — develop —and build high speed production equipment to meet your specific need. Write for details.



MORRIS MOR-SPEED RADIAL

Builders of MOR-SPEED Line

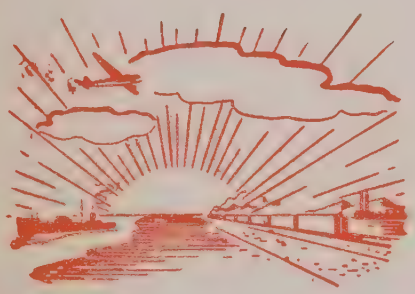
The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

West Coast . . .

ROBERT T. REINHARDT

• Along with the new year comes spectre of steel scrap needs . . . Bus production slows down. . . . West seeks larger share of shipbuilding.



SAN FRANCISCO—A 2½ million ton spectre, visible only to steel producers of the West Coast, was ushered into the world along with a new year.

Admittedly 2½ million tons is a hefty weight for any ordinary ghost, but the problem of buying that much steel scrap during this year is a very realistic apparition haunting every scrap buyer in this area. Some estimates indicate supply may fall as much as 400,000 tons short of requirements.

These buyers are thinking back to the prewar years when purchased scrap on the Coast amounted to less than 800,000 net tons which was readily developed locally. Today with western ingot capacity rated at 3,923,500 tons and actual production of approximately 4,074,000 tons anticipated, purchasing agents will be hard put to keep inventories anywhere near normal.

For the past year shipbreaking has been the salvation of the industry and this activity is practically at a standstill on the Coast. There is no indication from the Maritime Commission that additional ships will be offered for sale for this purpose, although the "moth-ball" fleet up in Suisun Bay looks like an untouched gold mine to steel producers.

Looking ahead a few months, some local buyers feel that off-shore scrap will move into West Coast ports in sufficient quantities to offer relief. However, based on deliveries during the past year, which were made in dribbles, this source can't be relied upon too heavily. While figures of actual deliveries to the West Coast from off-shore sources are not too reliable, best available estimates indicate that not more than 20,000 tons of low carbon scrap from Alaska, the Philippines and Japan got into the Pacific Northwest during the year; approximately 8000 to 10,000 tons came into the San Francisco Bay area, and perhaps the same in southern California. In addition about 10,000 tons of alloy billets came into San Francisco.

One importer of scrap from the Orient indicates as much as 150,000 tons may be shipped to the United States in 1949 but the largest part of that will go to East Coast ports.

Such ventures as that of the Independent Iron Works of Oakland, Calif. in which scrap from Hawaii has been barged into San Francisco area may make a minor contribution. Approximately 8000 tons of Hawaiian scrap has been brought in by Independent and approximately as much more is in the offing from this source.

In the final analysis well informed users of scrap are of the opinion that their greatest hope for normal inventories lies with the activity of the regular dealers and the opinion has been expressed that the Dept. of Commerce's drive will produce some results if top level executives can be stimulated to going out into their plants and authorizing the disposal of machines and tools which lower level executives hesitate to declare obsolete.

H. W. CHRISTENSEN, director of purchases for Columbia Steel Co. recently made a strong appeal to members of the Pacific Coast Conference, Institute of Scrap, Iron & Steel, to appreciate the fact that they constituted an important part of the industrial machine of the West and that every scrap dealer must assume a responsibility in maintaining a high steel production in this area. He said, in part, "We not only expect to keep our steelmaking facilities operating at capacity —we must—and you gentlemen of the Pacific Coast scrap industry are going to make your contribution to the industrial development of the West by producing this scrap for us."

In a recent interview Henry J. Kaiser told THE IRON AGE that in his opinion western furnaces would have to increase their pig iron charges materially to maintain anything like capacity production because of the vast amount of scrap that had been lost, not only to this area but nationally, through iron and steel shipments abroad during the war and which he declared was in the main, not returnable. Unquestionably this consideration and the availability of a good grade of ore from his Eagle Mountain mine were important factors in the decision to build another 1200 ton blast furnace at his Fontana plant.

Other western producers are not so fortunate in having blast furnaces of their own with the exception of the operations of U. S. Steel Corp. at Geneva, Utah. The operation there, of course, is predicated on supplying all of its scrap needs through home sources. However, other furnaces in the West continue to be dependent upon scrap for the major portions of their charges.

FOR the present at least most scrap buyers see no cause for alarm but all apparently realize

Keeping Company for 23 Years

Almost a quarter of a century ago, this Lorain-75 — equipped with a Twin Disc Clutch — worked for Highway Construction Company, Inc., on public-road jobs.

Today, this giant Lorain Moto-Crane — equipped with a Twin Disc 21-inch Hydraulic Coupling Power Take-Off — is operated by Jones and Laughlin Steel Corporation.

In November, 1925, The Thew Shovel Company installed a Twin Disc Clutch on its new Lorain-75 shovel, a machine that marked the beginning of Thew's present line of products.

Nearly 23 years later, Thew introduced a rubber-tired, two-engine Lorain Moto-Crane, equipped with a Twin Disc Hydraulic Power Take-Off. Moto-Crane, said to be the world's largest, weighs 65 tons and has a 45-ton capacity at a 12-foot radius.

For nearly a quarter of a century Twin Disc units have been used on heavy-duty equipment built by The Thew Shovel Company—one of 97 leading manufacturers of material-handling and earth-moving equipment who find Twin Disc Clutches and Hydraulic Drives efficient units for power transmission. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Hydraulic Torque Converter

Heavy Duty Clutch

Machine Tool Clutch

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

Tractor Clutch

Marine Gear

JUDGE TWIN DISC BY THE COMPANIES IT KEEPS

that within a few months there will have to be a concerted effort made to develop all scrap possible. There are already indications that automobile wrecking is increasing in tempo, although there is a tendency on the part of many scrap dealers to be more concerned with parts salvage than with complete wrecking. Confident observers feel, however, that within 6 months there will be a marked increase in the tempo of the scrap cycle and that once it is observed that this condition persists, an improvement in the overall supply situation should be seen.

It is hoped that the Scrap Drive Committee of the Dept. of Commerce will do more than write a few letters to business executives and then forget the whole matter. It is conceded that the scrap which can do the most good to alleviate the situation in the next few months is rather well hidden and must be pried loose. It is pointed out that here is an excellent chance for those members of the federal government who maintain that steel capacity nationally is inadequate, to do something about providing the necessary materials with which to keep present capacity operating somewhere near 100 pct.

Prices for openhearth scrap up and down the Coast have held firm for several months and there are no indications of immediate change. Raids on western territories by eastern producers have dwindled to a low point. Foundry grades of scrap have taken a drop within the past 2 to 3 weeks in all parts of the Coast as activity in that field declines and in all probability no return to the prices of 3 and 4 months ago can be expected for several months at least, according to well informed users and some realistic dealers.

•

Population Expansion Exceeds Transportation

Seattle

• • • **With mass** transportation posing serious problems in most western cities because of the rapid increase in population which has exceeded expansion of bus and rail lines it is somewhat surprising to many business men to learn that Kenworth Motor Truck Co. reports its bus business at a virtual standstill.

Only a few odd orders are now being filled and the 50 trackless trolleys that the city of Portland, Ore., had on order has been delivered. Practically all of the buses on order by small transit firms are likewise completed and shipped.

According to officials at Kenworth, business in the production of buses is off throughout the nation and their situation is no exception. Two reasons are advanced for this condition: credit restrictions have severely curtailed the buying power of small transit operators, thus eliminating many anticipated orders; these buyers need the new equipment but are having to limit their operations to the use of the old buses until additional capital can be secured or restrictions lifted on buying on time. The other reason offered is that transit companies and bus manufacturers over-estimated the market immediately after the war and the supposedly large backlog dwindled rapidly. Kenworth has had to reduce its payroll on the bus line by 150.

However, a brighter picture is found in the Kenworth motor truck division where production is level with last year's figures and no layoff has been necessitated in that department. This trend is reported as contrary to the national picture where the truck market and truck production has reportedly fallen off almost 40 pct in the last year.

•

Labor Plugs Shipbuilding

Seattle

• • • **Once more** organized labor is promoting a campaign to have a larger amount of government appropriations for shipbuilding assigned to West Coast yards.

A program to attain this goal will be submitted to the 9th annual convention of the Pacific District Council of the Metal Trades Council (AFL) on Jan. 17 at San Diego. Ed Rowan, special representative of Charles J. MacGowan, president of the International Boilermakers' Union and Thomas Rotell, secretary of the Pacific Coast District Metal Trades Council spearheaded this activity at the council's meeting recently in Centralia, Wash.

There are indications that the West Coast unions interested in furthering shipbuilding in their area may team up with their colleagues on the Gulf Coast in the battle against what they assert to be "discrimination."

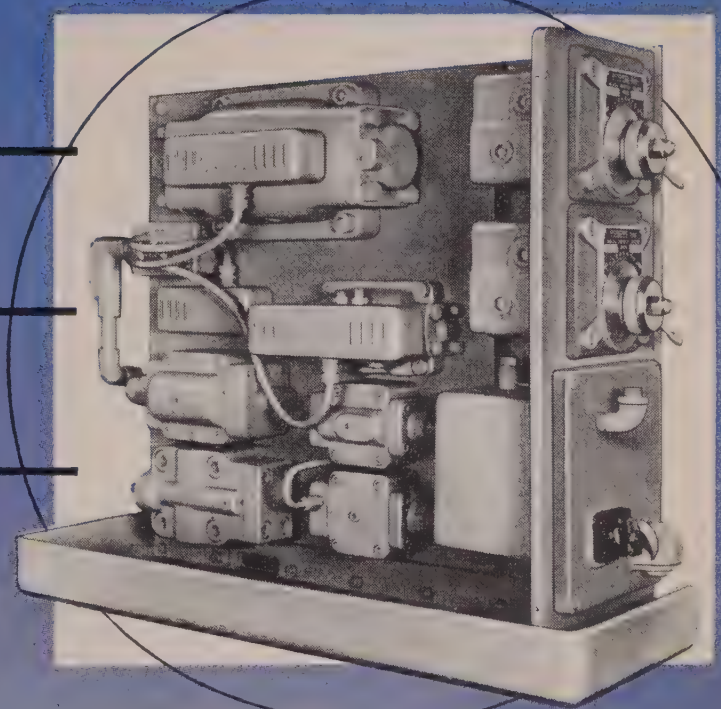
SELF-STARTER JET: *Members of the U. S. Navy Bureau of Aeronautics and the AiResearch Manufacturing Co. are shown inspecting a turbine developed for use with a high speed starter so that jet and turbojet aircraft can be self starting.*

VICKERS Gasket Mounted Hydraulic CONTROL VALVES

Simplify Installation

Save Space

Make Adjustment Easier



All hydraulic control units for the machine are included in this group. Flow control valve adjustments convenient to operator without opening panel box.

This new Colonial Pull-Down Broaching Machine is an excellent example of how Vickers Gasket Mounted Valves simplify installation, save space and make adjustment easier for hydraulic control systems.

All valves in the panel box are easily accessible for adjustment by simply removing the cover. For cleaning and other maintenance, any valve can be completely removed by just loosening the hold-down screws . . . the piping is not disturbed and the system is not drained. The installation is simplified and more compact because all hydraulic piping connections are made into the opposite side of the machined surface upon which the valves are mounted with sealing ring type gaskets. The concealed piping also results in improved appearance.

Contact the Vickers Application Engineering Office nearest you for suggestions on how Vickers Hydraulic Equipment can improve your machinery.

WRITE FOR NEW BULLETIN, 48-27

This bulletin will give you useful information regarding applications, advantages and installation drawings for Vickers Gasket Mounted Solenoid Controlled Directional Valves.

New Colonial Model RD-10-42 Pull-Down Broaching Machine has Vickers Hydraulic Controls.

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PERSONALS

° ° °

• **Harold W. Lahey** has been elected chairman of the board of directors of Ulster Iron Works, Dover, N. J., and **Frank W. Hamilton, Jr.,** has been elected president, succeeding his father, who died recently.

• **Calvin W. Verity** has resigned as director and chairman of the finance committee of Armco Steel Corp., Middletown, Ohio, and has been named as general consultant for the company.

• **Eugene K. Wright** has been appointed sales manager of the Manufacturers' Div., Continental Steel Corp., Kokomo, Ind., succeeding **K. H. Striebel,** who ras resigned. Mr. Wright joined Continental Steel in 1939 as sales representative of the Manufacturers' Div.

• **T. G. Harkins** has been named superintendent of the openhearth department, Midland Works, Crucible Steel Co. of America, Pittsburgh. Mr. Harkins recently returned to the United States after spending three years in South America, where he assisted in the erection and later operated the openhearth furnaces at the Volta Redona steel plant in Rio de Janeiro.

• **William T. Strickland, Jr.,** formerly sales contact engineer for Timken Roller Bearing Co., Chicago, has been transferred to the Houston office of the company, where he serves in a similar capacity.

• **James A. Whiting** has been appointed assistant superintendent of the Hubbard blast furnace of Youngstown Sheet & Tube Co., Youngstown, succeeding **James Hays,** who died.

• **Robert M. Arnold** has been appointed to a newly-created vice-presidency of Allegheny Ludlum Steel Corp., Pittsburgh. Mr. Arnold is president of Arnold Engineering Co., Chicago, a wholly-owned subsidiary, and a director of the parent company.

• **John S. Hawley** has been named assistant to the vice-president in charge of operations of the Colorado Fuel & Iron Corp., Buffalo. Mr. Hawley formerly served as manager of the California Wire Cloth Corp., a West Coast subsidiary.

• **Eugene F. Murphy** has been promoted to works manager of the American Locomotive Co. at Dunkirk, N. Y. Mr. Murphy had been superintendent of the plant. He has been with the company since 1912.

• **George J. Neumann** has been made vice-president of Lehigh Structural Steel Co., Allentown, Pa., succeeding T. R. Mullen, Jr., who died. **Leo I. Bruce** has been named secretary, which duties he performs in addition to those of his present position as general sales manager.

• **A. Tacchella** has become associated as project engineer with Engineering Controls, Inc., with his headquarters at Los Angeles.

• **George L. Mitsch** has been appointed plant manager at the St. Louis Foundry of American Car & Foundry Co., New York. Mr. Mitsch served as assistant plant manager at the time of his recent promotion.

• **R. E. Whinrey,** formerly superintendent, has been appointed to the newly-created position of assistant general manager of the Dodge plant in Indianapolis, Link-Belt Co., Chicago. **L. C. Heinlein,** formerly assistant superintendent, has been named superintendent of that plant.

• **John C. Keplinger** has been made executive vice-president, Hercules Motors Corp., Canton, Ohio. Mr. Keplinger formerly served as vice-president in charge of sales. He has been associated with the company since 1926.

• **Wallace C. Husted** has been elected executive vice-president of the Chase Brass & Copper Co., Inc., Waterbury, Conn. Mr. Husted joined Chase in 1929.

• **Albert L. Williams,** treasurer of International Business Machines Corp., New York, has been elected vice-president, which duties he performs in addition to those of treasurer. Mr. Williams joined the company in Pittsburgh in 1936.

• **George P. Edmonds** has been elected a member of the board of directors of Continental Can Co., New York.

• **Otis E. Grant** has been appointed sales manager for Superior Bearing Bronze Co., Brooklyn. Mr. Grant formerly served as eastern manager of the Eastern Div., Dow Chemical Co.

• **Robert L. Sommerville** has been appointed Exide's assistant general sales manager. Mr. Sommerville, who has been in the employ of the Electric Storage Battery Co., of Philadelphia, for 30 years, had formerly served as manager of automotive sales.

• **T. A. Dunne, J. E. Ferguson** and **W. R. Owens** have been named assistant divisional parts managers of Caterpillar Tractor Co., Peoria, Ill. Mr. Dunne serves with the Eastern Div., Mr. Ferguson with the Central Div., and Mr. Owens with the Western Div.

• **Emil Schaeffer** has been appointed chief engineer of the Tower Div., Elizabeth Iron Works, Inc., Elizabeth, N. J. Mr. Schaeffer at one time was connected as chief engineer with the Dept. of Steel Construction in the Krupp Works in Germany and since 1946, and previous to his new appointment, had conducted his own consulting engineering office here.

• **Andrew K. Foulds,** patent counsel for two of the subsidiaries of American Radiator & Standard Sanitary Corp., Pittsburgh, has been appointed patent counsel for the entire corporation, succeeding **C. G. Heylmun,** who is retiring. Mr. Foulds joined the patent department of American Radiator Co., a predecessor company of American-Standard, in 1926.

• **L. J. Suelzer** has been appointed manager of the newly-created Pittsburgh district office of Bowser, Inc., and **T. R. Schannen,** formerly sales engineer and assistant manager of the lubrication and filtration sales division, has assumed Mr. Suelzer's former position as manager of that division in Fort Wayne, Ind. **C. P. Menard,** formerly lubrication and filtration engineer in Pittsburgh, has been made sales engineer in the Pittsburgh office.

Rolling Steel DOORS

Manually • Mechanically • Power Operated

There's a Mahon Rolling Steel Door to meet your particular door requirement—whether it be manually, mechanically, or power operated, or an automatically closing Underwriters' Labeled Fire Door. Investigate the space saving advantages of these vertically acting doors, their permanence, and the greater protection they provide throughout a lifetime of trouble-free service. When you specify Mahon Rolling Steel Doors, you are assured the latest developments in doors of this type . . . you get more compact and more practical operators, with exclusive features which have proved very desirable in everyday operation. See Mahon Insert in Sweet's File for detailed information and complete specifications, or consult a Mahon representative.

THE R. C. MAHON COMPANY

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Manufacturers of Rolling Steel Doors, Shutters and Grilles, and Mahon Steel Deck for Roofs, Sidewalls, Partitions, Acoustical Ceilings, Permanent Floor Forms and Oversize Doors.

ROLLING STEEL DOORS, SHUTTERS AND GRILLES TO MEET EVERY REQUIREMENT

Three Mahon Power Operated Rolling Steel Doors, 26' x 12'-6", Recently Installed in the New Plant of Peninsular Metal Products Corp., Detroit, Michigan.

MAHON

European Letter . . .

• Pound sterling again among world's hard currencies . . . Ultimate credit due British people's austerity and capacity for self-discipline . . . Achievements justify satisfaction but not complacency.

LONDON—The Government has released the full text of the Four-Year Plan submitted to the Organization for European Economic Cooperation as token and proof of Britain's ability to put its economic affairs in order by the end of 1952. To call this document a Four-Year Plan is, indeed, a misnomer. The figures it contains are not promises but illustrations, and the detailed tables are to be regarded as no more than exercises in spelling out the results that might be expected to flow in the next four years from the policies that the Government proposes to follow.

But statistics can be doubly misleading if they are not only taken to be more accurate than they are but also distract attention to the details, which are infinitely variable, and away from the major outlines of policy, which are vital. The great virtue of the document is that it is a signpost, and the question it arouses is not whether the distances given on it are accurate but whether it points in the right direction.

THERE can be no doubt that, on the major issues of economic policy, the nation has been traveling during 1948 on the right road. Indeed, the best way of realizing what a distance has been traveled is to look back over 1947 and observe the almost magical change that has occurred in that sensitive barometer of national standing, the prestige and position of the pound sterling. A year ago the pound was shunned and suspect; now it is among the world's hard currencies. Then the world's criticism was that the British economy was incapable of paying its way; now it is that British policy is aiming at making the pound too scarce. This change is not entirely one of psychology and atmosphere; it has been produced by the restraint that has been shown in British spending abroad and the energy that has been shown in the export drive. When the figures of the current balance of payments are published, it is expected that they will show an overall balancing of payments and receipts, without the aid of Marshall dollars—that they will show a surplus in all other currencies approximately equal to the continuing deficit in dollars. This is a great achievement by any test, and though the ultimate credit belongs to the British people's capacity for self-control, by far the greatest individual share of praise attaches to Sir Stafford Cripps and the small circle of his intimate advisers. Not only has he shaped the policies and tenaciously defended them, he has also provided the essential moral foundation. A people that is being asked to exercise such severe self-discipline must be convinced that what is asked of it is asked for the good of the community not to flatter the vanity or foster the ambition of a politician. This confidence Sir Stafford has created in full measure.

Reprinted from the London Economist by special permission.—Ed.

The achievements of 1948 justify some satisfaction, but no complacency. The British national economy is still strained to the utmost. There are no margins for relaxation anywhere. It is only, so to speak, by standing on tiptoe that the nation contrives to measure up to its economic commitments. This cannot go on forever.

THE policies have been generally christened those of austerity, but for a large part they consist of a determination not to abate anything of the social ambitions conceived and of the political commitments entered into in the starry-eyed days of the war. Sir Stafford Cripps is not one of those Ministers who are reported to be willing to forego any item of the Labor Party's program; all must be carried out to the letter—nationalization, social welfare schemes, full employment, enhanced real wages and the rest. It is only in the carrying out of this program that the austerity enters in. By keeping up the maximum pressure for output, starving the home markets in favor of exports, cutting imports to the bone, maintaining rationing and control more severe than any other democratic nation's, persisting in a burden of taxes, seeking and accepting foreign subsidies — by doing all these things the nation can just, but only just, afford the extras it voted to itself when it thought it was going to be rich. That it can be done, at least for a year, has been demonstrated. But can it go on much longer? Can Sir Stafford preserve his precarious equilibrium in the middle of all the stresses and strains for even one more year, with his own party showing so clearly that it does not like the price of what it has ordered?

THE answer, we must all hope, is "Yes." For if it were "No," if the inspired gambles that make up the Four-Year Plan do not come off, if the targets are not reached, if the run of luck is bad, if the dollar deficit is not re-

There Go 3269 Fasteners!

onight's test is tough . . . Doc Smith ıust get through . . . he's depending n the miracle of American mass pro- uction and (unknowingly) on the 269 fasteners that give his car rength and stamina.

Over 500 screws . . . 331 nuts . . . 00 bolts . . . hundreds of rivets . . . ırnish the forces that lock auto- ıobile assemblies together.

With this responsibility that fast- ners must carry, it is obvious that quality is essential. That's why Russell, Burdsall & Ward makes the huge investment it does—in wire drawing mills of its own, in wire preparation, in laboratory equipment for extensive research, in advanced designs of equipment—all of which contribute to quality control.

Fastener *quality* and production savings go hand in hand. It isn't the initial price but the cost of *using* fasteners that counts. *T*rue *F*astener *E*conomy lies in *saving* assembly time, *reducing* the need for plant inspection, *getting* maximum holding power per dollar of fastener cost.

True Fastener Economy contributes to the kind of production savings that puts millions of new cars in U. S. driveways every year. It is this type of contribution to major American industries that explains why—for over 104 years—RB&W has been *making strong the things that make America strong.*

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Plants at: Port Chester, N.Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif. Additional sales offices at: Philadelphia, Detroit, Chicago, Chattanooga, Oakland, Portland, Seattle. Distributors from coast to coast.

3269 Fasteners are used in 1 small American car

104 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

ROADMAKER: *This entirely mobile asphalt and tarmacadam plant is 90 ft long and weighs almost 50 tons. It turns out 20 to 25 long tons of road material per hr and is operated by one man from a control panel. It was recently displayed at the Municipal Engineering Congress in London.*

moved by the continuance of present policies, then the alternative prospects that will face the country will be unpleasant for everybody alike. If the country finds that it cannot forever go on standing on tiptoe to reach the jam it thinks it deserves, and if its kind American friend will not forever provide a stool, then it has only two alternatives—either it must grow up very quickly or it must go without the jam. The former choice is, of course, to be preferred; but it is also likely to be much the more difficult to achieve. It has been apparent for a year past that no further great increase in output can be achieved by the present combination of exhortation and controls, of egalitarian taxation and welfare legislation. The great myth that the nationalization of an industry could quickly improve either its efficiency or its psychology has been exploded. If more needs to be done, it must be done by wholly new methods—and, what is more, by wholly new methods that require no more imports and reduce none of the pressure behind the export drive. It may not be wholly impossible to find some such new methods; but it might be safer to assume that they will not, in fact, be found. If that is so, the only practical alternative to the general lines of policy that Sir Stafford Cripps is following is a reduction either in the standard of living of the people, or in the social welfare legislation that all parties have joined to put on the statute books, or in the capital program that is the best long-term hope of escape from austerity. It is far better to hope that the Four-Year Plan works out as Sir Stafford expects it to.

Standardization of Nuts, Bolts, Screws Discussed

Cleveland

• • • Advantages and technicalities of the new uniform screw thread standards which will affect the nuts, bolts, and screws of Canada, Great Britain and the U. S. were discussed here recently at a symposium sponsored by the American Institute of Bolt, Nut and Rivet Manufacturers.

Basis of the meeting, which was attended by more than 200 leading engineering heads from the fasteners industry, was the standardization accord reached between the U. S., Canada, and Great Britain, which is aimed at producing a unified screw thread for nuts, bolts and screws to make them fully interchangeable.

Primary importance of such standardization is to make threaded parts produced in any of these nations interchangeable for the design and manufacture of original equipment and for replacement and repair of such equipment in the field.

Secondary, but important, accomplishment of the standardization was to overcome the objections held for certain phases of previous standards.

The basis of accord between the three nations regarding a universal screw thread design involved the changing of both thread designs previously followed. Canada and Britain had been following a system which was originated by Whitworth in 1845 and based upon a thread having an angle of 55 degrees with a thread form consisting of rounded crests and roots.

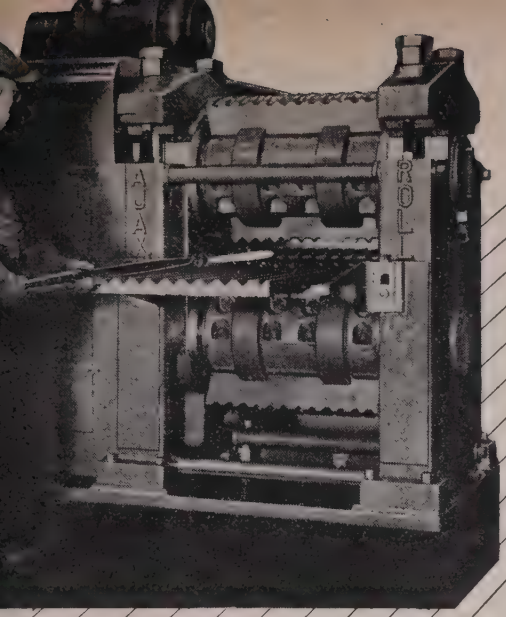
The American system was originally developed by Sellers in 1846 and followed a thread form having flattened crests and roots with an angle of 60 degrees.

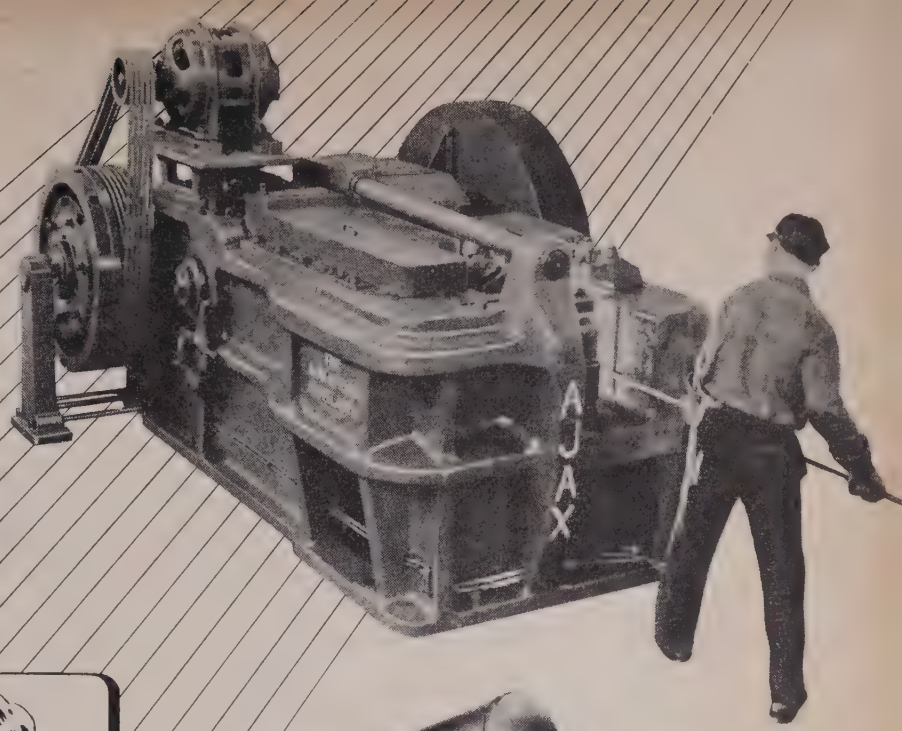
The new unified screw thread standard was agreed upon as having a 60 degree angle, the same as the present American standard thread but with a rounded root.

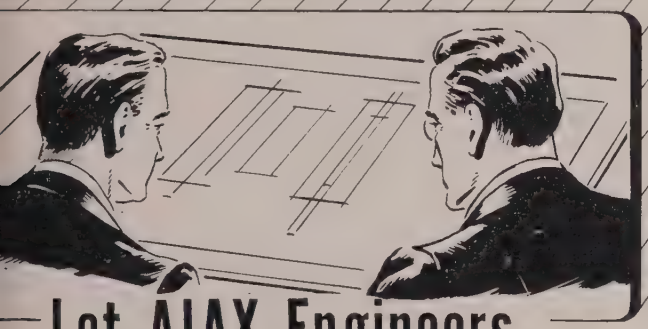
Little change was necessary in the number of threads per in., but a new ½-in. coarse thread was added having 12 threads per in in addition to the present 13 threads per in. to bring about uniformity. Three separate and new classifications of thread fit, or tightness, were also established.

Pointing out the advantages of unified thread design, W. C. Stewart, technical adviser of the institute, told the assembly that the thread forms, manufacturing tolerances and clearance between male and female threads had been worked out so that "there can be no interference between threads no matter what classes of threads are being assembled."

Two general types of thread fit can be obtained, he said; namely a relatively loose fit permitted by the variations in manufacturing tolerance plus a prescribed clearance allowance, and a snug fit where no clearance allowance is prescribed.







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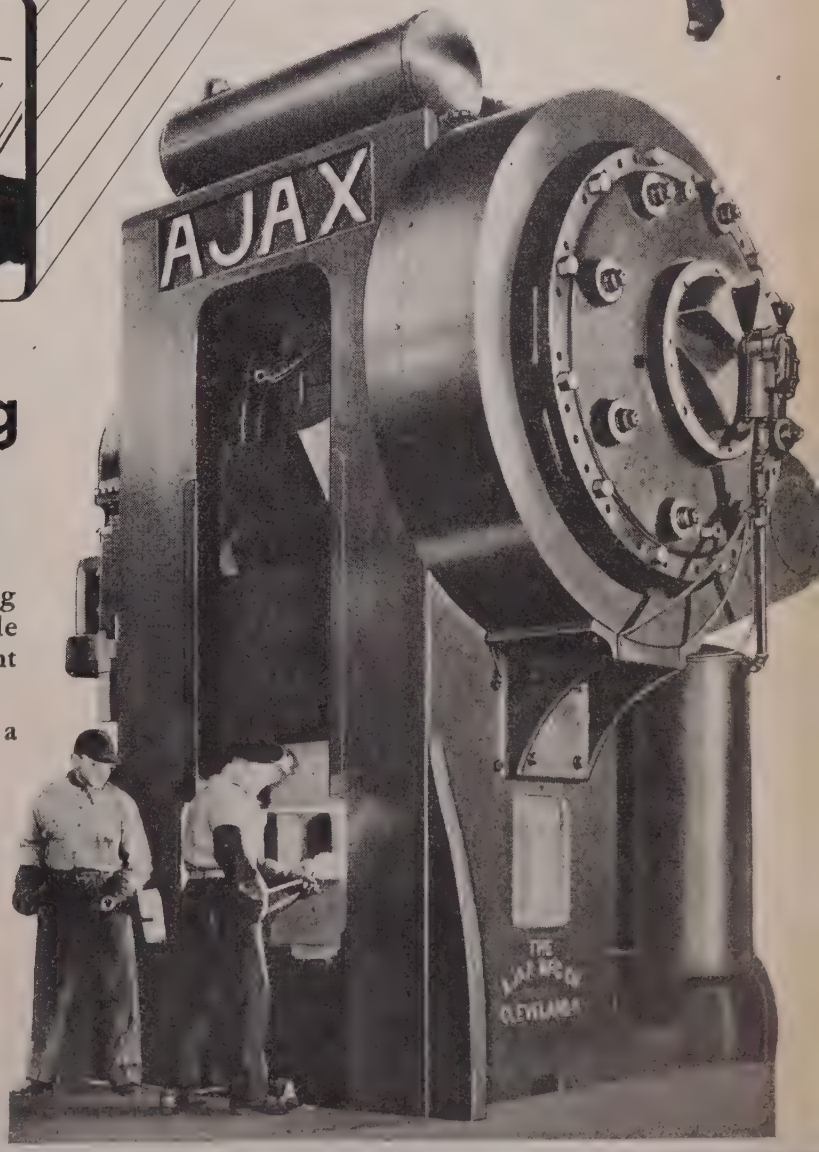
Ajax Manufacturing Company manufactures a plete line of forging machinery - - - Forging hines, Forging Presses, Forging Rolls etc. engineers, with the knowledge gained ugh research and development within their t and through constant contact with the most ressive forge plants in the country, are rts in the field of forging. Whether your blem concerns the selection of one piece of ng machinery for the forging of a single or a multiple unit production line set-up bar stock to the trimmed forging, Ajax neers will welcome the opportunity to assist wherever possible.



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• **IRON ORE UP**—Cleveland Cliffs Iron Co., announced Dec. 31, 1948, sale of substantial tonnages of iron ore to several consumers based on $7.20 per gross ton delivered lower lake ports for Mesabi range nonbessemer ore, 51.50 pct iron natural content, future increases or decreases in upper lake rail freight handling charges or taxes thereon to be for the buyers' account. Differentials for old range and bessemer grades will be the same as last year. The new price absorbs the 1948 increase in upper lake rail freight, which was paid by the purchaser, and adds approximately 86.5¢ per ton net to the amount paid last season. The new iron ore price represents an increase from 1939 of 45.5 pct, during which 10 year period labor cost in underground mines has increased over 100 pct. Other companies are expected to meet this new price.

• **TINPLATE**—Supply should come into balance with demand in the third quarter. Hardly sooner, because many big tinplate consumers don't feel they have enough inventory. Right now a few tinplate users are badly strapped for material because one mill has voluntarily reduced tinplate output and another has been forced to cut back by a mill alteration program. Exports will be dictated by Washington for some time, probably with little change in quantities. Consumption of tin will be stretched further by the continuing trend to wider use of electrolytic tinplate.

• **INLAND TINPLATE PRICES UP**—Inland Steel Co. has announced their new prices for tin mill products for domestic shipment effective Jan. 1. All prices are f.o.b. cars or trucks, their works, Indiana Harbor, Ind. The new tin mill product price is $7.75 per 100 lb base box for hot dipped coke tin plate 1.50 lb coating. The old price was $6.80 per base box.

• **PRODUCTION LOSS**—Columbia Steel Co. will lose an estimated 5000 tons of steel output as a result of damage to 2 openhearths by an oil and gas fire Christmas morning.

• **PLATES ROUGH**—The mad scramble for plates experienced last year taught us many lessons. Consumers are still yelling for all they can get, but they have already discontinued their blank check approach. Much of what happens to plate supply is tied directly to voluntary allocation programs. Most of these appear slated to continue. However, voluntary allocations involve government policies which are unpredictable. This is but one of the reasons plate users say this item and products made from plates remain the biggest single question mark this year.

• **SHEET AND STRIP**—A good part of the 3 million-ton postwar expansion of flat-rolled finishing facilities is already installed or due to be completed this year. And more raw steel has come and is coming to back it up. Pressure on sheet and strip has already eased. Steel sales executives look for this trend to continue. These are the signs that tell the story to date and which will be carefully watched this year: (1) the gray market is on the critical list, still alive but faltering; (2) conversion deals show a slight decline; and (3) buyers trying to shift to nearby mills to cut freight costs are occasionally meeting with success.

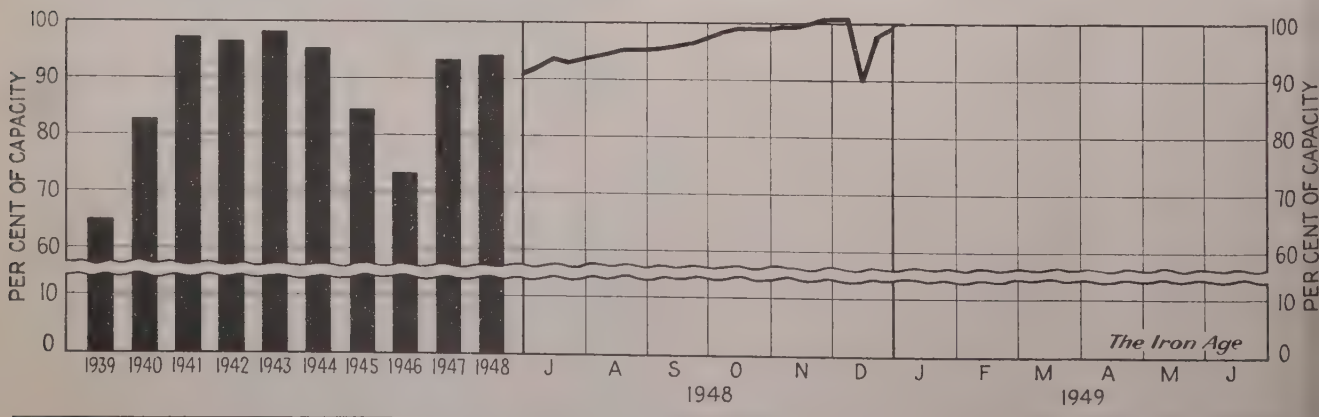
• **STRUCTURAL SHAPES**—Demand is still heavy. Unlike sheet and strip, a definite trend to better supply within 6 months is not apparent. Freight cars, tankers and barges together take a big bite of structural shape output and there are no signs of them being cut back. Despite a virtual lack of building for investment there is still a lot of industrial construction ahead.

• **COAL AND COKE**—Better coke and more of it will be one of the year's outstanding raw materials' developments. There will still be trouble with high sulfur coals despite new washers ready to start soon. But on an overall basis the effect on steelmaking of improvement in coke will be phenomenal judged against performance just 2 years ago. Steel mills now have huge coal stocks on the ground. They won't buy nearly as much coal in the open market this year as they did in 1948 unless John L. Lewis cuts captive mine operations to spread the work for his men.

• **DISCOUNT RESTORED**—Republic Steel Corp. has restored the 5 pct functional discount to jobbers and reduced direct shipment discount to 5 pct from the original 7½ pct. Changes are effective Dec. 28. Republic has also made minor changes in stainless steel forging billets revising prices downward less than 5 pct. Minor changes have also been in wrapping and packaging extras in polished sheets, mostly in boxing and burlapping. These also were effective Dec. 28.

• **POLISHING EXTRAS OFF**—Carnegie Illinois Steel Corp. has reduced polishing extras on stainless steel sheets, No. 4 finish, one side, gages 21 through 26. In publishing the December WP extra card an arithmetical error is said to have been made in figuring the extras on these gages. The reductions are retroactive to December. New extras are: gage 21, 13¢ per 100 lb; gage 22, 16.25¢ per 100 lb; gage 23, 17,75¢ per 100 lb; gage 24, 19.00¢ per 100 lb; gage 25, 22.75¢ per 100 lb and gage 26, 22.75¢ per 100 lb.

Steel Ingot Production by Districts and Per Cent of Capacity



Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
December 28...	97.5*	98.0*	89.5*	93.0	98.0*	105.0	98.0	102.0	101.0*	100.0	110.0	80.0	98.0	98.0
January 4.....	99.5	98.5	94.0	98.0	95.5	105.0	95.0	102.0	102.0	99.0	110.0	77.5	97.5	100.0

* Revised.

Industrial News Summary

- ***World Steel Output 168 Million Tons***
- ***Washington To Keep Checking On Steel***
- ***Foreign Ores To Complement U. S. Ores***

RECORD world steel production in the 21 major steel producing countries of 168 million tons during 1948 fell far short of meeting demand. United States participation in this figure totaled 88.5 million tons of steel ingots, which was short of the demand in this country.

For the waiting consumer, 1949 will bring more metals. Estimates for 1949 steel production are that 92 million tons of ingots may be produced. Exports of steel from the United States were sharply curtailed during 1948 and may be further reduced in the coming year. This reduction, plus the increased production, will mean that the most acute period of the steel shortage in this country will be over before the end of 1949. The supply position in other metals will remain generally tight but some easing is expected in most lines.

The political interest in Washington in steel capacity will mount so long as the shortage exists. If the steel industry is right, and existing steel capacity is adequate to take care of this country's long term needs, it will be showing signs of doing so before the end of 1949. But if the government economists are right and there is a need for 100 million tons plus of capacity for the long pull—another year of tight steel supply, if it stays tight, is about all that Congress is expected to tolerate.

Basic decisions will be made this year on some of the vexing iron ore problems that face the industry. A few years ago the possible future exhaustion of the Mesabi Range in Minnesota was a classical argument for steel men. But during the past year, the very real prospects of our dependence on foreign ores became front page news. Conservative ore men indicate that the new ore finds in Quebec-Labrador and Venezuela will be shipping 12 million tons of ore annually by 1960, and 24 million tons 10 years later.

WITH the passing of the Mesabi, the era of low priced steel in this country will be over. The relative cost of iron ore per unit by 1960 is expected to be 40 to 50 pct higher than it is today. The mining of low grade ores in this country is sure to increase as the high grades disappear. These ores will increase raw materials costs to the steel industry substantially.

The lines are drawn for a battle in Washington on the basing point system of pricing. While the steel industry abandoned it in favor of F.O.B. mill selling last year, steel men have indicated a willingness to go back to it if a clear cut legal decision is available.

Hearings in Washington on the subject have only confirmed that there is a great deal of confusion on basing points that must be cleared up before judicial wisdom can be obtained. So far, most consumers of steel have been unable to separate F.O.B. mill selling of steel and a price increase on steel that came along at about the same time. As a package, these made a poor deal for the user of steel. He has therefore lined up in opposition to mill selling of steel.

The technology of oxygen used to speed operations in the steel industry is beginning to advance sufficiently that some rational ideas can be gleaned from its results. The use of oxygen will not be any cure-all for the lack of an adequate number of steelmaking furnaces today. There is a great deal of developmental work to be done before any national results will show up. But there are specific plants and companies that can for the year 1948 show that increased tonnages of steel were made available by the use of oxygen.

THERE is a feeling in the automotive industry that the present designs of new cars including those to be introduced this month will have to do for auto users for several years to come. The style changes effected in the past 2 years have been aimed at capturing the public fancy. They have often ignored the economics of metal supply and the buyer's purse. Design work done in the near future is expected to be directed toward manufacturing economies and conservation of raw material supplies.

Although still in the throes of a tight supply situation from a raw materials standpoint, many metal consuming plants are preparing themselves now for the time when the selling bonanza is over. There is increasing talk of making war born technical improvement in industry actually reduce basic costs and permit lower selling prices. Much work is being done to improve handling techniques in machine shops so that time savings effected with new high speed cutting techniques may be matched with corresponding savings in the time consumed in parts handling.

The steel ingot operating rate this week was up two points to 100.0 pct of rated capacity, thus regaining the preholiday level.

Kelly's Creek Colliery Company

solves a costly maintenance problem with

J&L HEAT-TREATED JALLOY STEEL

J&L STEEL

Unretouched photographs of the sluices in the McNally-Pittsburg Coal Washer at the Maiden Mine, Maidsville, W. Va. (Above) Sluices filled with fast-moving coal and water. (Right) Water flows over the exposed JALLOY plates.

Sluice-plates formerly replaced monthly . . .
Now heat-treated JALLOY plates last 10 times as long

Slide 300 tons of coal *an hour*—day in and day out—down the steel sluices of a coal washer, and you would *expect* the bottom plates to wear out rapidly. Kelley's Creek Colliery Company* considered monthly replacements quite normal for sluice bottom-plates—until they put in J&L *heat-treated* JALLOY Steel. Now they get 10 times longer service. This means lower maintenance cost . . . higher profits.

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JALLOY is a heat-treated, manganese-molybdenum steel developed by J&L for just such uses as these—for resisting extreme abrasion and heavy shock.

Manufacturers and maintenance men, alike, find that JALLOY heat-treated plate makes equipment last longer. The outstanding wear-resistant properties of this *modern* steel have been proved again and again in such applications as: Bulldozers . . . Scrapers . . . Rock crushers . . . Power-shovel buckets . . . Dump cars . . . Truck bodies . . . and Sand-blast equipment.

If abrasion is a limiting factor in the life of *your* equipment or products, you'll find it profitable to investigate JALLOY. Let us send you the booklet mentioned in the coupon.

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Jones & Laughlin Steel Corporation
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AISI President Reviews Steel Industry's Best Peacetime Achievement

New York

• • • **Furnaces of the** steel industry poured out more than 88 million tons of raw steel during 1948, an amount larger than ever before in peacetime, according to Walter S. Tower, president of the American Iron and Steel Institute. The total was more than half of the world's output of steel. The steel tonnage represented about 94 pct of all the metals produced in the United States, and it lacked only a few days' production of reaching the top wartime output of steel during 1944.

Walter S. Tower

Record steel production permitted the country's principal manufacturing industries to turn out a rising stream of thousands of different products for the American economy and employ more persons than at any prior time. All major classes of industry benefited by the increase in steel shipments during 1948. The needs of certain essential industries were met under the voluntary allocation programs supervised in Washington.

Even more impressive than the year's total output of steel was the steel industry's high production in the Autumn of 1948. An all-time monthly record tonnage was established in October and a new record weekly production set in November. The latter was at the rate of 94 million tons of raw steel per year.

Sees Foreign Sales Drop

New York

• • • **The sales volume** of printing machinery and equipment in foreign markets will most likely be less in 1949 than during the past 12 months, when sales surpassed any prewar year, according to Louis E. Pleninger, vice-president, foreign sales, American Type Founders Sales Corp., Elizabeth, N. J.

"The world-wide shortage of dollars will more severely restrict the American manufacturer doing business in foreign markets," he said, "and sufficient industrial recovery is being made by several European countries to offer sharp competition."

Sears Reducing Prices

Chicago

• • • **Sears, Roebuck & Co.,** largest mail order house in the country, has cut prices an average of 1.7 pct on its Spring-Summer merchandise.

The cuts are effective with the 1949 Spring-Summer catalog, which was mailed to customers last week. Textiles and wearing apparel showed the biggest cuts.

Alan Wood Steel Co. Adopts Pension Plan For Salaried People

Philadelphia

• • • **Stockholders** of Alan Wood Steel Co. have approved the adoption of a contributory pension plan for salaried employees of that company and its wholly owned subsidiary, Upper Merion & Plymouth Railroad Co.

The plan, which became effective Dec. 31, 1948, will be offered to approximately 315 employees. All salaried employees between the ages of 25 and 65, who have been employed by either company for 2 years or more, will be eligible. Age 65 will be the normal retirement age.

The two companies plan to pay the entire cost of the portion of

Ho Hum!

the pension representing past service, and approximately two-thirds of the cost of the pension representing future service. The employee will contribute about one-third of the "future service" pension cost.

The amount of pension to be received by a retired employee will depend upon his length of service with the company and his average salary earned.

Reading Co. Buys Cars

Philadelphia

• • • **Directors of** the Reading Co. have authorized the purchase of 750 50-ton steel hopper cars at an approximate cost of $3,200,000. The cars will be constructed at Bethlehem Steel Co.'s plant at Johnstown, Pa.

Joint Sale of Warren Plant Proposed by WAA

Washington

• • • **Proposal for** a package sale of several government owned steelmaking facilities at Warren, Ohio, has been made by the War Assets Administration.

Properties included in the package include Plancors 333 (an alloy steel plant), 334 (heat-treating plant), 383 (alloy steel annealing), 1130 (pig iron and ingot metal for electric furnaces), as well as the privately owned Copperweld steel plant.

As a basis for bidding, prospective purchasers must include a basic amount of $10.9 million of which $5.4 million would be for purchase of Copperweld-owned land on which the facilities are standing. The remaining $5.5 million would be for purchase of Copperweld inventories.

Bids, with a binder of $500,000, will be received by WAA in Washington, D. C., until 1:55 p. m. (EST) on Jan. 21, 1949.

U. S. Steel's Improvements

New York

• • • U. S. Steel's record peacetime steel production and shipments reflect partially the completion of numerous postwar improvements and additions to its facilities, according to Irving S. Olds, chairman of the board.

The company has authorized expenditure of over $900 million for modernization and expansion since V-J Day. Of this amount more than $650 million has already been invested in this program.

Following is a summary of the major additions and improvements undertaken in all parts of the country by U. S. Steel's subsidiaries.

Subsidiary	Facilities
Carnegie Illinois	
Irvin Works	Continuous heavy gage galvanizing line Continuous light gage galvanizing line Improved cold strip rolling facilities
Vandergrift Works	Two continuous coil annealing lines 54-in. cold reduction mill Temper rolling mill for production of silicon steels
Clairton Coke Works	Two batteries of coke ovens rebuilt One new battery constructed
National Tube Co. (Gary)	Seamless pipe mill modernized and rebuilt
National Tube Co. (Lorain)	Buttweld pipe mill Three batteries of by-product coke ovens Modern pipe warehouse Soaking pits* Blooming Mill* Continuous seamless pipe mill* Three Bessemer Converters*
South Chicago Works	Two blast furnaces (To replace two smaller furnaces)
Gary Works	One blast furnace enlarged (Two enlarged previously) Installation of turbo blowers etc. in blast furnaces Four-stand tandem sheet rolling mill Battery of by-product coke ovens
American Steel & Wire Co.	
Waukegan, Ill. Plant	Stainless steel wire mill*
Duluth Works	35 pct increase in steelmaking capacity
Cuyahoga Works Cleveland	More cold rolling equipment for special strip steel
Joliet Works	Equipment for intermediate sizes of low carbon wire
Geneva Steel Co.	Conversion of plate mill to hot rolled coil mill
Geneva, Utah	Improved handling facilities in plate finishing mill*
Columbia Steel Co.	
Pittsburg, Calif.	Sheet and tinplate mill
Torrance, Calif.	Sheet mill

*Work in progress

First Hot Rolled Coils Rolled at Geneva Plant

Geneva, Utah

• • • **The first** experimental coils of hot-rolled steel were manufactured successfully last week in Geneva Steel Co.'s plant here, according to Dr. Walther Mathesius, president of this U. S. Steel subsidiary.

Regular commercial manufacture of coils in the converted Geneva plate mill will follow early next month as the new machinery is tuned to smooth running order. The hot rolled coils, each weighing up to about 13,000 lb, will be shipped to Columbia Steel Co.'s cold reduction mill in Pittsburg, Calif., for cold rolling into tin plate and sheets. Geneva is also expected eventually to supply hot rolled coils to another cold reduction mill currently under construction in the Los Angeles area.

In addition to the new line of coils, the Geneva plant will continue its regular production of steel plates of many sizes and thicknesses and of structural mill products (THE IRON AGE, Nov. 18, p. 149). The plant was built for the government by U. S. Steel in 1942 to manufacture ship plates and structural shapes for the war. The government sold the plant to the corporation 2 years ago.

Names Waltham Trustees

Boston

• • • **Waltham Watch Co.,** America's oldest watch maker, is on the rocks. U. S. District Court Judge George C. Sweeney has appointed three trustees to administer the company. This action followed a petition for reorganization under Chapter 10 of the Federal Bankruptcy Act.

The trustees were reported looking to Boston banks for funds to continue operating the company temporarily.

American Steel & Wire Expanding Duluth Works

Duluth

• • • **American Steel** & Wire Co., here, now has underway an expansion program which will increase steel production by 243,000 net tons a year. These products will be in the form of semifinished, wire and manufacturers' and merchant wire products. The expansion will take place in the steel melting department, soaking pit and annealing divisions. Replacement of 57 of the plant's coke ovens is included in the program.

Two openhearth furnaces which were partially dismantled and taken out of service during the thirties are at present being replaced. The old furnaces were 110 ton capacity. The new furnaces will tap 135 tons, and they are stationary furnaces. These furnaces will be erected in existing buildings on the foundations which were used for the two previous furnaces.

In order to handle the additional ingot tonnage the company will add additional soaking pits. Previous to this the old type warming pits were used. The new pits will be modern gas fired pits of the circular type. Auxiliary equipment such as ladles, charging buggies, mold cars and cinder pot cars will be replaced or modernized to match the increased output of this plant. Openhearth construction is expected to be finished in July and the new pits, it is hoped, will be in operation by August.

The 57 coke ovens which are to be replaced by a battery of Koppers design will be equipped with self-sealing doors and will use burners of the gun firing type. Construction on the ovens is expected to start early in January and will take about 1 year to complete. The new coke unit will be located south of and adjacent to the existing ovens in order to maintain coke production during the construction period. There will be no change made in the by-product facilities.

Ford Sees Buyers' Market

New York

• • • **Higher production,** possibility of a buyers' market before the year end, no model changes and a trend toward improved quality of cars were envisioned by Henry Ford II, president of Ford Motor Co., in his 1949 forecast.

Although Ford makes about half its own steel, shortage of the metal is again seen as a limiting factor on output.

Urging More Car Orders

New York

• • • **The controversy** over how much steel should be voluntarily allocated for freight car building and construction continues. The carriers and the steel industry are each strongly supported by several government agencies.

Meanwhile William T. Faricy, Assn. of American Railroads president, is prodding the carriers to order more cars. He wants more than 100,000 cars added to the backlog. These would be used as ammunition for his verbal battle for more steel.

AEC Contract May Bring Atom Powered Ship Closer

Pittsburgh

• • • **The first attempt** to build an atomic powered marine engine will begin here within a few months. The Chicago office of the U. S. Atomic Energy Commission announced Dec. 28 that Westinghouse Electric Corp., Pittsburgh, had been given a contract to build an experimental nuclear reactor that could be used to drive ships.

The AEC will be responsible for design, development and engineering. Westinghouse has the job of detail engineering, construction and operation of the reactor. Charles H. Weaver, manager of Westinghouse's Atomic Power Div. said that the project will employ about 600 people and that construction would begin soon. He said the job will be to find a way to use atomic energy to generate heat to make steam to run a turbine.

While radiation insulation might take up at least as much room as present day fuel tanks, an atomic energy powered vessel could be driven much faster and stay at sea a lot longer than oil powered ships.

Norton Planning Purchase

Boston

• • • **Premier** Maurice Duplessis has announced from Quebec City that the Norton Co., with head offices in Worcester, Mass., will soon open a plant manufacturing abrasives at Cap De La Madeleine, Quebec. The firm will spend about $1,000,000, he said, in making alterations to the plant of the Durham Chemicals Co. of Canada, which the Norton Co. proposes to purchase.

Blast Furnace Capacity and Production

AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N. Y.

NOVEMBER - 1948
Month

	Number of companies	Annual blast furnace capacity	Production							
			Pig Iron		Ferro manganese and spiegel		Total		Percent of capacity	
			Current month	Year to date	Current Month	Year to date	Current month	Year to date	Current month	Year to date
Distribution by Districts:										
Eastern	11	13,093,560	1,006,176	10,204,968	34,605	324,591	1,040,781	10,529,559	96.9	87.8
Pittsburgh-Youngstown	17	25,588,120	2,023,048	21,313,866	25,853	218,483	2,048,901	21,532,349	97.6	91.9
Cleveland-Detroit	6	6,495,000	529,546	5,516,901	-	-	529,546	5,516,901	99.4	92.8
Chicago	7	14,700,290	1,157,756	11,389,428	-	10,190	1,157,756	11,399,618	96.0	84.7
Southern	8	4,949,660	403,883	4,139,248	8,840	89,869	412,723	4,229,117	101.6	93.3
Western	3	2,612,300	209,571	2,046,248	-	-	209,571	2,046,248	97.8	85.6
Total	35	67,438,930	5,329,980	54,610,659	69,298	643,133	5,399,278	55,253,792	97.6	89.5

MACHINE TOOLS

. . . News and Market Activities

Current Order Volume Static; Change May Come Later in Month

• • • **No change in** machine tool order volume was in the offing this week, and probably not before President Truman's inauguration, Jan. 20, when buyers in major sales sectors will have a better idea of the direction the political wind will blow.

Continuation of ECA and the defense program are practically assured, but the attitude of a Democratic administration on price controls, excess profits taxes, and accelerated depreciation of capital equipment could indirectly cast the machine tool industry into the role of prince or pauper for the next 2 years.

Signs of government spending are already more numerous. Ordnance plants and arsenals have been making inquiries and aircraft parts and components manufacturers have asked for quotation on equipment.

National Screw Machine Products Assn. recently reported that there is more than a remote possibility that any wholesale manufacturer of ammunition components will find many bar stock jobs being turned into steel forgings, due not only to saving of material but also to alleviate scrap transportation difficulties. This would require the use of many chucking machines. A NSMPA check made with the drop forging industry brought forth the fact that less than 10 pct of the companies in that industry are offering machining services and leaving the machining problem entirely up to the purchaser of forgings to find a machining source.

In Cleveland, Lloyd D. McDonald, president, National Machine Tool Builders' Assn., and vice-president, Warner & Swasey Co., announced that NMTBA membership will be open hereafter to the "individuals, copartnerships and corporations engaged in the manufacture of metal-forming machine tools as well as metal-cutting machine tools.

An amendment to the constitution of the association has added to its membership qualifications clause this sentence: "A metal-forming machine tool is a power-driven machine, not portable by hand, used to press, forge, emboss, hammer, blank, or shear metal."

Mr. McDonald, who was chairman of the committee on qualifications for association membership prior to his election as president, said that this definition of a metal-forming machine tool does not include die casting machines, extruding machines, rolling mills or welding equipment.

The stated purpose of the NMTBA is now "to promote the lawful interests of the metal-cutting and metal-forming machine tool industry (known as the machine tool industry) in the direction of good business ethics; the liberal discussion of subjects pertaining to improvement, standardization and the methods of manufacturing and marketing tools."

Serving with Mr. McDonald on the committee, whose proposal was adopted by vote of the membership, were: L. W. Scott Alter, American Tool Works Co., Cincinnati; Swan E. Bergstrom, Cincinnati Milling Machine Co.; Rudolph W. Glasner, Clearing Machine Corp., Chicago; Victor W. Peterson, Hannifin Corp., Chicago, and Thorvald S. Ross, Rivett Lathe & Grinder, Inc., Boston.

Also in Cleveland, a recent Associated Industries survey revealed that more than 90 pct of the companies contacted reported purchases of new machinery since 1945. About 8 pct reported retooling completely within the past year, which in some instances had enabled them to step up production as much as 30 pct.

In Quebec, it was reported this week that Norton Co., Worcester, will open a plant in the near future at Cap de la Madeleine, Quebec, for the manufacture of abrasives. According to reports, Norton plans to spend about $1 million in making alterations to the plant of Durham Chemicals Co. of Canada, which Norton Co. proposes to purchase. Norton has branches at Chippewa, Ont., Hamilton, Ont., and in England, France and Australia.

Procurement Regulations Of Air, Navy, Published

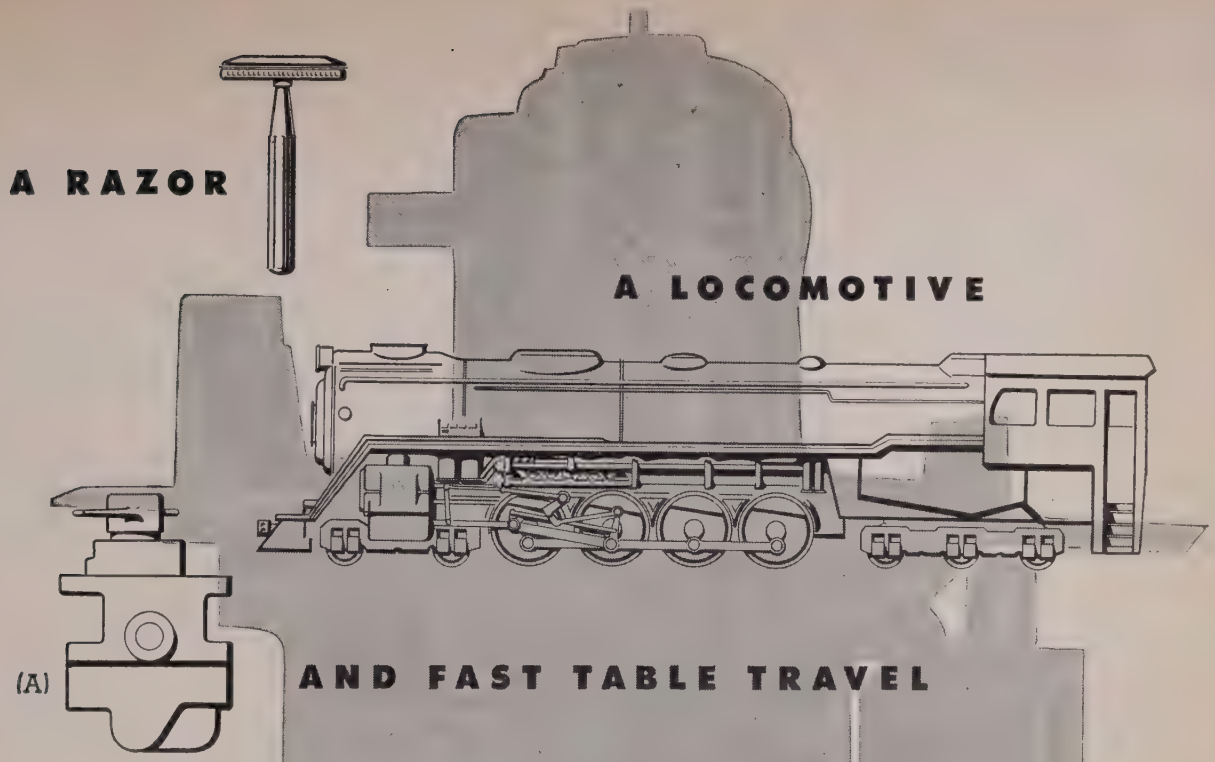
Washington

• • • **The National** Military Establishment has begun publication of new regulations which spell out how the Renegotiation Act of 1948 is to be applied in contracts for procurement of aircraft and aircraft parts.

The regulations affect procurement by the Dept. of the Air Force and the Dept. of the Navy. Secretary of Defense Forrestal said in announcing the new regulations that publication would be made piecemeal as the various sections of the regulations are completed.

"In an effort to inform contractors and subcontractors at the earliest possible date of their duties and obligations under the Renegotiation Act of 1948, it has been decided to publish the regulations issued under the authority of that act as the various parts thereof are completed," Mr. Forrestal's office stated. The first two parts—Parts 421 and 422—were published last week, and the remaining parts—423 through 430—will be published during the next several months.

The two parts already published deal with (1) the authority and organization for renegotiation and (2) with the procedure for renegotiation. They are available at the Superintendent of Documents, Government Printing Office, Washington 25, D. C..



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*Accuracy within 0.00025 limits

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GRAND RAPIDS GRINDERS

NONFERROUS METALS

. . . News and Market Activities

Metals Markets Firm; But Consumers Resist Gray Market Prices

New York

• • • **The metal markets** were very firm at year end. Producers have been successful in holding down price increases so far despite strikes at properties of copper, lead and zinc producers that seriously restricted production. Premium prices were still being paid for copper, lead and zinc by some consumers but the pressure is off as many consumers are resolutely opposed to paying gray market prices. The secondary lead market has dropped considerably in the last few weeks, permitted by the ending of the St. Joseph Lead strike. Last week it developed that some smelters were charging $50 a ton for battery plates, which brings about a lower scrap lead price.

The copper market is expected to remain very tight for the next several months at least, due to continuation of the Utah Mine strike. In the face of the strike, wire mill demand is still very strong, and brass mills are seeking metal but pressure to get copper is reported to have lowered some.

Demand is still heavy for all grades of zinc. Some pressure is reported to be off Special High Grade due to a reduction in die casting business estimated at 15 pct. Producers still have backlogs of orders for this grade. Some die casters say that the reduction in business is temporary and due to changes in design. They say that they will be after more metal next year. Others point to the state of the washing machine market and other consuming industries and expect the trend to continue. The strike at two plants of American Zinc, Lead & Smelting Co. continues.

•

Tin Conservation System To Run 6 Months Longer

Washington

• • • **With minor changes,** the present tin conservation program will be extended for another 6 months through June 30, 1949.

This means roughly that use of tin by individual manufacturers for can making will still be restricted under Order M-81 to one-half their tinplate receipts in 1947.

In announcing the extension of the program, H. B. McCoy, director of the Office of Domestic Commerce, said that manufacturers are expected to make adequate provision for the food pack, to make fair distribution within various groups of can users with consideration for small business, and to provide for needs of new fabricators.

Order M-43 has been revised effective as of Jan. 1. First quarter allocations on other than tinplate will be based on 27½ pct of the total pig tin allocated during the calendar year 1948. Previously, allocations were based on 1946 second quarter allocations. Pig tin allocations for tinplate are based on a fixed tonnage.

Any receipts of pig tin in excess of the amounts set up for allocation will be set aside for inclusion in the nation's strategic stockpiling program.

Other changes in M-43 include (a) the basis for importation of tin alloys as announced last August has been made part of the order; (b) makes the certification requirements procedure mandatory for all items covered by the order; (c) permits use of up to 7 pct tin in aluminum alloy bearings; and (d) includes in the order the optional use of .50 lb and heavier electrolytic tinplate for hot dipped tinplate under Schedule V.

Monthly Average Prices

• • • **The average prices of the major nonferrous metals in December based on quotations appearing in The Iron Age, were as follows:**

	Cents Per Pound
Electrolytic copper, Conn. Valley	23.50
Lake copper, Conn. Valley	23.625
Straits tin, New York	$1.03
Zinc, East St. Louis	17.50
Zinc, New York	18.15
Lead, St. Louis	21.30
Lead, New York	21.50

•

Refractories Fellowships

New York

• • • **In the interest** of furthering the training of technologists for the refractories industry, the American Refractories Institute has sponsored fellowships for worthy graduate students who are interested in the study of problems relating to refractory materials. Eight fellowships on refractories have been established at universities having ceramic departments.

•

Carboloy Slashes Prices

Chicago

• • • **A standardized** line of solid carbide cylinders, both ground and unground, at sharply reduced prices in quantities of 50 and over has been announced by Carboloy Co., Inc., Detroit. The line is comprised of 115 sizes. New lower prices have also been established on standard Carboloy blanks in quantities of 700 and over.

The company said the lower prices have been made possible by the more extensive use of mass production equipment.

Nonferrous Metals Prices

	Dec. 29	Dec. 30	Dec. 31	Jan. 3	Jan. 4
Copper, electro, Connecticut	23.50	23.50	23.50	23.50	23.50
Copper, Lake, Connecticut	23.625	23.625	23.625	23.625	23.625
Tin, Straits, New York	$1.03	$1.03	$1.03	$1.03	$1.03
Zinc, East St. Louis	17.50	17.50	17.50	17.50	17.50
Lead, St. Louis	21.30	21.30	21.30	21.30	21.30

Primary Metals

(Cents per lb, unless otherwise noted)

Aluminum, 99+%, 10,000 lb, freight allowed	17.00
Aluminum pig	16.00
Antimony, American, Laredo, Tex.	38.50
Beryllium copper, 3.75-4.25% Be dollars per lb contained Be	$24.50
Beryllium aluminum 5% Be, dollars per lb contained Be	$52.00
Cadmium, del'd	$2.00
Cobalt, 97-99% (per lb)	$1.65 to $1.72
Copper electro, Conn. Valley	23.50
Copper, lake, Conn. Valley	23.625
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.8%, dollars per troy oz.	$2.25
Iridium, dollars per troy oz.	$110 to $115
Lead, St. Louis	21.30
Lead, New York	21.50
Magnesium, 99.8+%, f.o.b. Freeport, Tex.	20.50
Magnesium, sticks, carlots	34.50
Mercury, dollars per 76-lb flask, f.o.b. New York	$92 to $94
Nickel, electro, f.o.b. New York	42.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per troy oz.	$89 to $93
Silver, New York, cents per oz.	70.00
Tin, Grade A, New York	$1.03
Zinc, East St. Louis	17.50
Zinc, New York	18.15
Zirconium copper, 10-12 pct Zr, per lb contained Zr	$12.00

Remelted Metals

Brass Ingot

(Published prices, cents per lb delivered, carloads)

85-5-5-5 ingot		
No. 115	21.00*	22.00
No. 120	20.50*	21.50
No. 123	20.00*	21.00
80-10-10 ingot		
No. 305	....	27.25
No. 315	....	24.25
88-10-2 ingot		
No. 210	....	33.00
No. 215	....	31.00
No. 245	24.75*	25.75
Yellow ingot		
No. 405	17.00*	17.50
Manganese bronze		
No. 421	....	23.00

* F.o.b. Philadelphia.

Aluminum Ingot

(Cents per lb, lots of 30,000 lb)

95-5 aluminum-silicon alloys	
0.30 copper, max.	31.25–31.75
0.60 copper, max.	30.75–31.25
Piston alloys (No. 122 type)	26.50–27.00
No. 12 alum. (No. 2 grade)	26.25–26.75
108 alloy	26.50–27.00
195 alloy	27.00–27.25
13 alloy	31.00–31.50
AXS-679	27.25–27.75

Steel deoxidizing aluminum, notch-bar granulated or shot

Grade 1—95 pct-95½ pct.	28.75–29.50
Grade 2—92 pct-95 pct.	27.75–28.50
Grade 3—90 pct-92 pct.	26.75–27.50
Grade 4—85 pct-90 pct.	26.25–26.75

Electroplating Supplies

Anodes

(Cents per lb, freight allowed, in 500 lb lots)

Copper	
Cast, oval, 15 in. or longer	40⅛
Electrodeposited	34⅜
Rolled, oval, straight, delivered	37.34
Ball anodes	38⅜
Brass, 80-20	
Cast, oval, 15 in. or longer	35⅞
Zinc, oval, 99.99	
Ball anodes	
Nickel 99 pct plus	
Cast	59.00
Rolled, depolarized	
Cadmium	$2.10
Silver 999 fine, rolled, 100 oz. lots, per troy oz, f.o.b. Bridgeport, Conn.	79

Chemicals

(Cents per lb, f.o.b. shipping point)

Copper cyanide, 100 lb drum	46.00
Copper sulfate, 99.5 crystals, bbls.	9.10
Nickel salts, single or double, 100 lb bags, frt. allowed	18.50
Nickel chloride, 300 lb bbl.	24.50
Silver cyanide, 100 oz. lots, per oz.	59
Sodium cyanide, 96 pct domestic 100 lb drums	16.00
Zinc sulfate, crystals, 22.5 pct, bags	
Zinc sulfate, 25 pct, granules, bbls. frt. allowed	

Mill Products

Aluminum

(Base prices, cents per pound, base 30,000 lb, f.o.b. shipping point, freight allowed)

Flat Sheet: 0.188 in., 2S, 3S, 26.9¢; 4S, 61S-O, 28.8¢; 52S, 30.9¢; 24S-O, 24S-OAL, 29.8¢; 75S-O, 75S-OAL, 36.3¢; 0.081 in., 2S, 3S, 27.9¢; 4S, 61S-O, 30.2¢; 52S, 32.3¢; 24S-O, 24S-OAL, 30.9¢; 75S-O, 75S-OAL, 38¢; 0.032 in., 2S, 3S, 29.5¢; 4S, 61S-O, 33.5¢; 52S, 36.2¢; 24S-O, 24S-OAL, 37.9¢; 75S-O, 75S-OAL, 47.6¢.

Plate: ¼ in. and heavier: 2S, 3S, F, 23.8¢; 4S-F, 26¢; 52S-F, 27.1¢; 61S-O, 26.6¢; 24S-F, 24S-FAL, 27.1¢; 75S-F, 75S-FAL, 33.9¢.

Extruded Solid Shapes: Shape factors 1 to 4; 35.1¢ to 66¢; 11 to 18, 36.1¢ to 78¢; 23 to 25, 38.2¢ to $1.07; 35 to 37, 45.7¢ to $1.65; 47 to 49, 67.5¢ to $2.41.

Rod, Rolled: 1.064 to 4.5 in., 2S-F, 3S-F, 34¢ to 30.5¢; Cold-finished, 0.375 to 3.5 in., 2S, 3S, 36.5¢ to 32¢.

Screw Machine Stock: Drawn, ⅛ to 11/32 in., 11S-T3, R317-T4, 49¢ to 38¢; cold-finished, ⅜ to 1½ in., 11S-T3, 37.5¢ to 35.5¢; ⅝ to 2 in., R317-T4, 37.5¢ to 34.5¢; rolled, 1 9/16 to 3 in., 11S-T3, 35.5¢ to 32.5¢; 2⅛ to 3⅝ in., R317-T4, 33.5¢ to 32.5¢. Base 5000 lb.

Drawn Wire: Coiled, 0.051 to 0.374 in.: 2S, 36¢ to 26.5¢; 52S, 44¢ to 32¢; 56S, 47¢ to 38.5¢; 17S-T4, 50¢ to 34.5¢; 61S-T4, 44.5¢ to 34¢; 75S-T6, 76¢ to 55¢.

Magnesium

(Cents per lb, f.o.b. mill, freight allowed Base quantity 30,000 lb)

Sheet and Plate: Ma, FSa, ¼ in., 54¢-56¢; 0.188 in., 56¢-58¢; B & S gage 8, 58¢-60¢; 10, 59¢-61¢; 12, 63¢-65¢; 14, 69¢-74¢; 16, 76¢-81¢; 18, 84¢-89¢; 20, 96¢-$1.01; 22, $1.22-$1.31; 24, $1.62-$1.75. Specification grade higher.

Extruded Round Rod: M, diam. in., ¼ to 0.311, 58¢; ½ to ¾, 46¢; 1¼ to 1.749, 43¢; 2½ to 5, 41¢. Other alloys higher.

Extruded Square, Hex. Bar: M, size across flats, in., ¼ to 0.311, 61¢; ½ to 0.749, 48¢; 1¼ to 1.749, 44¢; 2½ to 4, 42¢. Other alloys higher.

Extruded Solid Shapes, Rectangles: M, in weight per ft, for perimeters of less than size indicated, 0.10 to 0.11 lb. per ft. per. up to 3.5 in., 55¢; 0.22 to 0.25 lb per ft, per. up to 5.9 in., 51¢; 0.50 to 0.59 lb per ft, per. up to 8.6 in., 47¢; 1.8 to 2.59 lb per ft, per. up to 19.5 in., 44¢; 4 to 6 lb per ft, per. up to 28 in., 43¢. Other alloys higher.

Extruded Round Tubing: M, wall thickness, outside diam, in., 0.049 to 0.057, ¼ to 5/16, $1.14; 5/16 to ⅜, $1.02; ½ to ⅝, 76¢; 1 to 2 in., 65¢. 0.065 to 0.082, ⅜ to 7/16, 85¢; ⅝ to ¾, 62¢; 1 to 2 in., 57¢. 0.165 to 0.219, ⅝ to ¾, 54.5¢; 1 to 2 in., 53¢; 3 to 4 in., 49¢. Other alloys higher.

Nickel and Monel

(Cents per lb, f.o.b. mill)

	Nickel	Monel
Sheets, cold-rolled	60	47
Strip, cold-rolled	66	50
Rods and shapes		
Hot-rolled	56	45
Cold-drawn	56	45
Angles, hot-rolled	56	45
Plates	58	46
Seamless tubes	89	80
Shot and blocks	..	40

Copper, Brass, Bronze

(Cents per pound, freight prepaid on 200 lb)

	Extruded Shapes	Rods	Sheets
Copper	36.78	....	37.18
Copper, hot-rolled	....	33.03	....
Copper, drawn	....	34.28	....
Low brass	38.57*	35.35	35.66
Yellow brass	37.60*	34.28	34.59
Red brass	38.92*	35.70	36.01
Naval brass	34.90	33.65	39.59
Leaded brass	....	29.24	....
Commercial bronze	39.54*	36.57	36.88
Manganese bronze	38.49	36.99	43.09
Phosphor bronze, 5 pct	57.80*	56.30	56.05
Muntz metal	34.47	33.22	37.66
Everdur, Herculoy, Olympic, etc.	40.49	40.76	41.82
Nickel silver 10 pct	....	47.17	44.77
Architectural bronze	33.42	....	....

* Seamless tubing.

Scrap Metals

Brass Mill Scrap

(Cents per pound; add ½¢ per lb for shipments of 20,000 lb or more)

	Heavy	Turnings
Copper	21⅛	20⅝
Yellow brass	18⅞	18⅛
Red brass	20	19¼
Commercial bronze	20⅛	19⅝
Manganese bronze	18¾	17⅞
Leaded brass rod ends	18⅛	

Custom Smelters' Scrap

(Cents per pound, carload lots, delivered to refinery.)

No. 1 copper wire	20.50
No. 2 copper wire	19.50
Light copper	18.50
Refinery brass	18.25–18.50

Ingot Makers' Scrap

(Cents per pound, carload lots, delivered to producer.)

No. 1 copper, wire	19.75
No. 2 copper, wire	18.75
Light copper	17.75
No. 1 composition	16.50
No. 1 comp. turnings	16.25
Rolled brass	12.75–13.25
Brass pipe	13.25–13.75
Radiators	14.00–14.50
Heavy yellow brass	12.50–12.75
Aluminum	
Mixed old cast	16.00
Mixed old clips	16.00
Mixed turnings, dry	14.50
Pots and pans	16.50
Low copper	19.00

Dealers' Scrap

(Dealer's buying prices, f.o.b. New York in cents per pound)

Copper and Brass

No. 1 heavy copper and wire	18½—19
No. 2 heavy copper and wire	17½—18
Light copper	16½—17
Auto radiators (unsweated)	12 —12¼
No. 1 composition	14½—15
No. 1 composition turnings	14 —14½
Clean red car boxes	12 —12½
Cocks and faucets	12 —12½
Mixed heavy yellow brass	9 — 9½
Old rolled brass	11½—12
Brass pipe	13 —13½
New soft brass clippings	15 —15½
Brass rod ends	13 —13½
No. 1 brass rod turnings	12½—13

Aluminum

Alum. pistons and struts	8 — 8½
Aluminum crankcases	12 —12½
2S aluminum clippings	16 —16½
Old sheet & utensils	12 —12½
Borings and turnings	6 — 6½
Misc. cast aluminum	12 —12½
Dural clips (24S)	12 —12½

Zinc

New zinc clippings	10½—11
Old zinc	9 — 9½
Zinc routings	5¼— 5¾
Old die cast scrap	5¾— 6¼

Nickel and Monel

Pure nickel clippings	22 —23
Clean nickel turnings	17 —18
Nickel anodes	22 —23
Nickel rod ends	21 —22
New Monel clippings	15½—16½
Clean Monel turnings	11 —12
Old sheet Monel	13 —14
Old Monel castings	10 —11
Inconel clippings	12 —13
Nickel silver clippings, mixed	8 — 8½
Nickel silver turnings, mixed	7 — 7½

Lead

Soft scrap lead	18 —18½
Battery plates (dry)	11½—12

Magnesium Alloys

Segregated solids	8 — 9
Castings	4½— 5½

Miscellaneous

Block tin	82 —84
No. 1 pewter	65 —67
No. 1 auto babbitt	51 —53
Mixed common babbitt	19 —19½
Solder joints	21½—22½
Siphon tops	50 —52
Small foundry type	20½—21
Monotype	19½—20
Lino. and stereotype	19 —19½
Electrotype	17½—18
New type shell cuttings	15½—16
Hand picked type shells	6½— 7
Lino. and stereo dross	10½—11
Electro dross	7 — 7½

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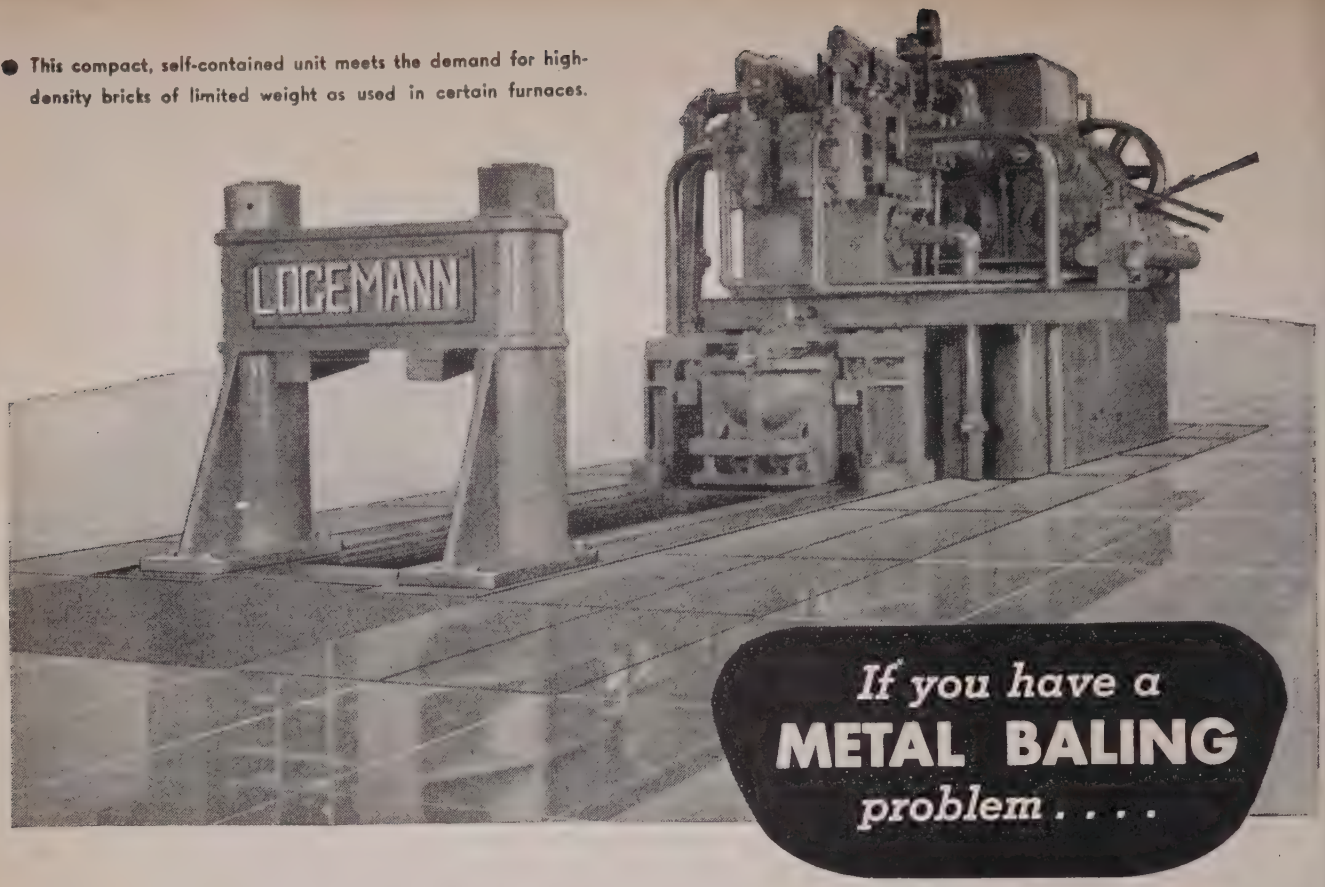

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Cast Grades Slump Further Downward

New York

• • • The cast grades continued their preholiday slumps this week with substantial drops in some of the major market areas.

Although the mills are favorably situated on heavy melting scrap, there were no price changes in those grades. Instead mills are very selective in the type of scrap they accept and expect to do only limited buying during January.

Railroad specialties are generally weak. In Chicago the bottom dropped out of this and the cast markets. Declines in other market areas were not as severe, however.

The annual scrapmen's convention is scheduled for Jan. 17 and 18 in Cincinnati. Following is an outline of the program of business and social events which will take place at the Netherland Plaza Hotel.

SUNDAY, JANUARY 16

1 p.m.—Registration, 4th floor foyer.

3 to 9 p.m.—Hospitality Room (food buffet and bar), sponsored by brokers and dealers, Pavilion Caprice, 4th floor.

3 p.m.—Meeting of Finance Committee.

7 p.m.—Meeting of Board of Directors, Parlor H, 4th floor.

MONDAY, JANUARY 17

8:30 a.m.—Registration, 4th floor foyer.

10 a.m.—Opening business session, Hall of Mirrors, 3rd floor, Herman D. Moskowitz, president, presiding.
Address of welcome on behalf of host chapter, by Ralph Kopelove, president, Cincinnati chapter.
Outline of convention events, by Maurice D. Friedman, general convention chairman.
Remarks by the president, Herman D. Moskowitz.
A Look into the Scrap and Steel Markets in 1949, by Thomas W. Lippert, directing editor, THE IRON AGE.
1949—Time for Building the Company and National Team, by Whiting Williams, consultant on labor problems, Cleveland.
What the Steel Industry Expects from the Scrap Industry in 1949, by Leo F. Reinartz, general manager, Middletown division, Armco Steel Corp.

12 to 2 p.m.—Hospitality Room (food buffet and bar) sponsored by brokers and dealers, Pavilion Caprice, 4th floor.

2 p.m.—Business session continued, Hall of Mirrors, Edward L. Solomon, first vice president, presiding.
A Safety Program for Scrap Industry, by Louis L. Brott, director of public relations of the Institute.
How Safety Lowers Costs and Increases Production, by William G. Marks, chief engineer, bureau of labor standards, Department of Labor.
Possibilities in Further Mechanization of Scrap Yards, by E. J. Afram, Milwaukee.
Forum on safety and mechanization, with discussion from floor.

7 p.m.—Annual banquet (informal), Hall of Mirrors. Herman D. Moskowitz, toastmaster.
The national anthem, by Louis G. Hehman.
Invocation.
Introduction of guests at speakers' table.
Presentation of awards.
Remarks, Mayor Albert D. Cash, of Cincinnati.
Address, the Hon. Alben W. Barkley, Vice President-elect of the United States.

TUESDAY, JANUARY 18

8:30 a.m.—Registration.

10 a.m.—Annual business meeting of Institute; for members only, Hall of Mirrors, Herman D. Moskowitz presiding.
Report of the secretary, Stanley M. Kaplan.
Report of the treasurer, Samuel G. Keywell.
Report of the executive vice president, Edwin C. Barringer.
Remarks by Sidney Danzinger, president, National Association of Waste Material Dealers, Inc., and Richard E. Dwor, president, Canadian Secondary Materials Association.
A Public Relations Program for the Scrap Industry, by Louis L. Brott, director of public relations of the Institute.
A Blueprint of the Future of the Scrap Industry, by Charles H. Lipsett, publisher, Waste Trade Journal and Daily Metal Reporter.
Objective and Mechanics of Department of Commerce Scrap Drive, by Alex Miller, scrap consultant to the Department of Commerce.

12 to 2 p.m.—Hospitality Room (food buffet and bar), sponsored by brokers and dealers, Pavilion Caprice, 4th floor.

2 p.m.—Annual business meeting of Institute concluded; for members only. Hall of Mirrors.
Necrology.
Good and welfare:
Chapter Activity and Planning, by Jack Levand, president, Northern Ohio chapter of Institute, and Samuel R. Hurwich, president, Indiana chapter.
How to combat service organizations.
Shall net ton succeed gross ton as basis for transactions in scrap?
Shall trade customs of scrap industry be codified?
Shall Institute revive its freight rate bureau?
Nominations will be made for 6 directors-at-large and ballots cast at some period in Tuesday's proceedings when the presiding officer deems attendance adequate.

4 p.m.—Meeting of Board of Directors, Parlor H, 4th floor. (This meeting will be convened immediately following adjournment of afternoon business session.)

7:30 p.m.—Cincinnati Night (informal), for ladies and men; dinner dance, Hall of Mirrors and Pavilion Caprice.

Ladies Program Included

A Special program has also been lined up for the ladies. It begins with a luncheon at 8 p.m. on Sunday, Jan. 16, and continues through the following Tuesday.

PITTSBURGH—Steelmaking scrap buyers were still out of the market at the beginning of the week. Though mill inventories are reportedly still very good, trade sources expected some limited buying during the month. Following the $2 drop in dealer scrap in Chicago it was expected that when any new orders are closed for these grades a $2 dip would materialize here. No. 1 steel would not likely be affected. Price declines were chalked up in rail crops, low phos and cast grades. No. 1 and mixed yard cast were off $1, heavy breakable was down $3. Malleable was off $2, sympathetically. The dip in low phos was $1.

•

CHICAGO—Scrap dealers claim the present market is worse than 1932 as far as activity is concerned. The market is tissue paper thin making it almost impossible to find going prices. The bottom fell out of the railroad specialty market last week. It was a record drop. It might drop further. Openhearth scrap items remain very weak. Republic Steel was offered 50,000 tons of dealers' scrap at $40—they turned it down cold. Carnegie is expected to buy in January but the tonnage will be small.

•

CLEVELAND—Buyers here and in the valley are canceling earmarked orders and whistling "Back in the Saddle Again." The market is punchy and only 6 weeks of deep snow will revive it. Inventories are big but with the exception of blast furnace grades, which were being refused at less than market prices, there will probably be little buying under current price levels in the state of Ohio during January.

•

DETROIT — Indications of underlying weakness in the Detroit scrap market are more in evidence this week but prices remain at earlier levels. Local mills are buying in January at market prices but all indications point to a real test of the present prices when February contracts are placed. Both local mills and scrap yards appear to be carrying inventories that are substantially larger than a year ago. The low operating rate of most Detroit foundries has threatened to pull down the price for cast grades. Turnings and other blast market grades are again leaning toward the weak side.

•

BUFFALO—Activity in scrap was at low ebb last week as a result of the customary year end lag. One of the leading open hearth consumers cancelled all overdue contracts to clear its books for the new year and the chief low phos interest remained out of the market. A broker who usually acts for the principal consumer of No. 1 steel lowered his buying price to $47.50 which compared with $48.50 a short time back.

Going prices as obtained in the trade by THE IRON AGE, based on representative tonnages.

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. melting	$42.50 to	$43.00
RR. hvy. melting	43.50 to	44.00
No. 2 hvy. melting	42.50 to	43.00
RR. scrap rails	58.00 to	59.00
Rails 2 ft and under	60.00 to	61.00
No. 1 comp'd bundles	42.50 to	43.00
Hand bdld. new shts.	42.50 to	43.00
Hvy. axle turn.	45.50 to	46.50
Hvy. steel forge turn.	45.50 to	46.50
Mach. shop turn.	37.50 to	38.00
Shoveling turn.	39.00 to	40.00
Mixed bor. and turn.	37.50 to	38.00
Cast iron borings	39.50 to	40.00
No. 1 mach. cast	67.50 to	68.50
Mixed yard cast	63.00 to	64.00
Hvy. breakable cast	59.00 to	60.00
Malleable	74.00 to	75.00
RR. knuck. and cup.	57.00 to	58.00
RR. coil springs	57.00 to	58.00
RR. leaf springs	57.00 to	58.00
Rolled steel wheels	57.00 to	58.00
Low phos.	48.50 to	49.50

CHICAGO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$41.50 to	$42.00
No. 2 hvy. melting	39.50 to	40.00
No. 1 bundles	41.50 to	42.00
No. 2 dealers' bundles	39.50 to	40.00
Bundled mach. shop turn.	39.50 to	40.00
Galv. bundles	37.00 to	38.00
Mach. shop turn.	34.50 to	35.00
Short shov. turn.	36.50 to	37.00
Cast iron borings	35.50 to	36.00
Mix. borings and turn.	34.50 to	35.00
Low phos. hvy. forge	47.00 to	48.00
Los phos. plates	44.50 to	46.00
No. 1 RR. hvy. melt.	43.75 to	44.25
Rerolling rails	64.00 to	65.00
Miscellaneous rails	55.00 to	57.00
Angles & splice bars	48.00 to	50.00
Locomotive tires, cut	48.00 to	50.00
Cut bolster & side frames	46.00 to	48.00
Standard stl. car axles	76.00 to	80.00
No. 3 steel wheels	47.00 to	48.00
Couplers and knuckles	47.00 to	48.00
Rails, 2 ft and under	57.00 to	58.00
Malleable	72.00 to	75.00
No. 1 mach. cast	60.00 to	62.00
No. 1 agricul. cast.	57.00 to	60.00
Heavy breakable cast.	56.00 to	57.00
RR. grate bars	56.00 to	57.00
Cast iron brake shoes	55.00 to	56.00
Cast iron car wheels	60.00 to	61.00

CINCINNATI

Per gross ton, f.o.b. cars:

No. 1 hvy. melting	$40.00 to	$41.00
No. 2 hvy. melting	40.00 to	41.00
No. 1 bundles	40.00 to	41.00
No. 2 bundles	40.00 to	41.00
Mach. shop turn.	35.00 to	36.00
Shoveling turn.	37.00 to	38.00
Cast iron borings	36.00 to	37.00
Mixed bor. & turn.	35.00 to	36.00
Low phos., 18 in. under	48.00 to	49.00
No. 1 cupola cast.	62.00 to	63.00
Hvy. breakable cast.	56.00 to	57.00
Rails 18 in. and under	61.00 to	63.00
Rails random length	56.00 to	57.00
Drop broken	69.00 to	70.00

BOSTON

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$37.00 to	$38.90
No. 2 hvy. melting	34.40 to	34.40
Nos. 1 and 2 bundles	34.40 to	34.40
Bushelings	34.40 to	34.40
Shoveling turn.	31.00 to	33.00
Machine shop turn.	29.40 to	31.00
Mixed bor. and turn.	29.40 to	31.00
Cl'n cast chem. bor.	37.00 to	38.00
No. 1 machinery cast.	64.00 to	65.00
No. 2 machinery cast.		53.00
Heavy breakable cast.		52.50
Stove plate	52.00 to	53.00

DETROIT

Per gross ton, brokers' buying prices f.o.b. cars:

No. 1 hvy. melting		$38.00
No. 2 hvy. melting		38.00
No. 1 bundles		38.00
New busheling		38.00
Flashings		38.00
Mach. shop turn.	$31.00 to	32.00
Machinery cast	60.00 to	62.00
Mixed yard cast	56.00 to	57.00
Shoveling turn.	31.50 to	32.00
Cast iron borings	32.50 to	33.00
Mixed bor. & turn.	31.50 to	32.00
Low phos. plate	42.50 to	43.00
Heavy breakable cast.	53.00 to	57.00
Stove plate	57.00 to	58.00
Automotive cast.	64.00 to	66.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. melting	$44.00 to	$45.00
No. 2 hvy. melting	41.00 to	41.50
No. 1 bundles	44.00 to	45.00
No. 2 bundles	41.00 to	41.50
Mach. shop turn.	37.00 to	38.00
Shoveling turn.	41.00 to	41.50
Mixed bor. and turn.	36.75 to	37.25
Clean cast chemical bor.		nominal
No. 1 machinery cast.	63.00 to	64.00
No. 1 mixed yard cast.	58.00 to	60.00
Hvy. breakable cast.	59.00 to	60.00
Hvy. axle forge turn.	46.00 to	47.00
Low phos. acid, openhearth	47.00 to	48.00
Low phos., electric furnace	50.00 to	51.00
Low phos. bundles	46.00 to	47.00
RR. steel wheels	52.00 to	53.00
RR. coil springs	52.00 to	53.00
RR. malleable	78.00 to	79.00
Cast iron carwheels	64.00 to	65.00

ST. LOUIS

Per gross ton delivered to consumer:

No. 1 hvy. melting	$44.00 to	$45.00
No. 2 hvy. melting	39.50 to	40.50
Bundled sheets	39.50 to	40.50
Mach. shop turn.	32.00 to	34.00
Shoveling turnings	35.00 to	36.00
Locomotive tires, uncut	47.00 to	48.00
Mis. std. sec. rails	55.00 to	57.00
Steel angle bars	53.00 to	54.00
Rails 3 ft and under	60.00 to	62.00
RR. steel springs	49.00 to	50.00
Steel car axles	73.00 to	75.00
Brake shoes	54.00 to	56.00
Malleable	75.00 to	77.00
Cast iron car wheels	64.00 to	65.00
No. 1 machinery cast.	66.00 to	67.00
Hvy. breakable cast.	60.00 to	61.00

BIRMINGHAM

Per gross ton delivered to consumer:

No. 1 hvy. melting		$40.00
No. 2 hvy. melting		40.00
No. 2 bundles		40.00
No. 1 bunsheling		40.00
Long turnings	$32.00 to	33.00
Shoveling turnings	35.00 to	36.00
Cast iron borings		29.50
Bar crops and plate	45.00 to	46.00
Structural and plate	45.00 to	46.00
No. 1 cupola cast.	68.00 to	70.00
Stove plate	65.00 to	67.00
No. 1 RR. hvy. melt.		41.00
Steel axles	65.00 to	68.00
Scrap rails	48.00 to	49.00
Rerolling rails	65.00 to	67.00
Angles & splice bars	53.00 to	54.00
Rails 3 ft & under	53.00 to	54.00
Cast iron carwheels	63.00 to	64.00

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. melting	$42.50 to	$43.00
No. 2 hvy. melting	42.50 to	43.00
Mach. shop turn.	37.50 to	38.00
Short shov. turn.	39.00 to	40.00
Cast iron borings	36.50 to	37.00
Low phos.	47.50 to	48.00

NEW YORK

Brokers' buying prices per gross ton, on cars:

No. 1 hvy. melting	$38.50 to	$39.00
No. 2 hvy. melting		37.00
No. 2 bundles		37.00
Mach. shop turn.	31.50 to	32.00
Mixed bor. & turn.	31.50 to	32.00
Shoveling turnings	33.50 to	34.00
Machinery cast.	58.00 to	59.00
Mixed yard cast	54.25 to	55.25
Heavy breakable cast.	53.00 to	54.00
Charging box cast.	53.00 to	54.00
Unstrp. motor blks.	52.50 to	53.50
Cl'n cast chem. bor.	37.50 to	38.50

BUFFALO

Per gross ton delivered to consumer:

No. 1 hvy. melting	$47.00 to	$49.00
No. 2 hvy. melting	41.75 to	42.25
No. 1 bundles	41.75 to	42.25
No. 2 bundles	41.75 to	42.25
No. 1 busheling	41.75 to	42.25
Mach. shop turn.	36.75 to	37.25
Shoveling turn.	38.75 to	39.25
Cast iron borings	37.75 to	38.25
Mixed bor. and turn.	36.75 to	37.25
Clean auto. cast.	67.00 to	69.00
Mixed yard cast.	63.00 to	66.00
Stove plate	63.00 to	66.00
RR. malleable	70.00 to	75.00
Small indus. malleable	47.00 to	49.00
Low phos. plate	48.00 to	50.00
Scrap rails	....	58.00
Rails 3 ft & under	63.00 to	64.00
RR. steel wheels	56.00 to	58.00
RR. coil & leaf spgs.	56.00 to	58.00
RR. knuckles & coup.	56.00 to	58.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. melting	$42.00 to	$42.50
No. 2 hvy. melting	42.00 to	42.50
No. 1 bundles	42.00 to	42.50
No. 1 busheling	42.00 to	42.50
Drop forge flashings	42.00 to	42.50
Mach. shop turn.	37.00 to	37.50
Shoveling turn.	36.50 to	37.00
Steel axle turn.	42.00 to	42.50
Cast iron borings	36.50 to	37.00
Mixed bor. & turn.	36.50 to	37.00
Low phos. 2 ft and under	47.00 to	47.50
No. 1 machinery cast.	70.00 to	72.00
Malleable	77.00 to	79.00
RR. cast.	72.00 to	74.00
Railroad grate bars	58.00 to	61.00
Stove plate	61.00 to	63.00
RR. hvy. melting	43.00 to	43.50
Rails 3 ft and under	62.00 to	63.00
Rails 18 in. and under	63.50 to	64.50

SAN FRANCISCO

Per gross ton, f.o.b. shipping point:

No. 1 hvy. melting	....	$27.50
No. 2 hvy. melting	....	27.50
No. 2 bales	....	27.50
No. 3 bales	....	24.50
Mach. shop turn.	....	18.00
Elec. fur. 1 ft under	$40.00 to	42.00
No. 1 cupola cast.	58.00 to	60.00
RR. hvy. melting	....	28.50
Rails	....	29.00

LOS ANGELES

Per gross ton, f.o.b. shipping point:

No. 1 hvy. melting	....	$27.50
No. 2 hvy. melting	....	27.50
No. 1 bales	....	27.50
No. 2 bales	....	27.50
No. 3 bales	....	24.50
Mach. shop turn.	....	20.00
Elec. fur. 1 ft under	$40.00 to	42.00
No. 1 cupola cast.	40.00 to	50.00
RR. hvy. melting	....	28.50

SEATTLE

Per gross ton delivered to consumer:

No. 1 & No. 2 hvy. melt.	$30.00 to	$33.50
Elec. fur. 1 ft and under	36.50 to	40.00
No. 1 cupola cast.	40.00 to	40.50
RR. hvy. melting	30.00 to	32.50

HAMILTON, ONT.

Per gross ton delivered to consumer: Cast grades f.o.b. shipping point:

Heavy melting	$23.00*	
No. 1 bundles	23.00*	
No. 2 bundles	22.50*	
Mechanical bundles	21.00*	
Mixed steel scrap	19.00*	
Mixed borings and turnings	17.00*	
Rails, remelting	23.00*	
Rails, rerolling	26.00*	
Bushelings	17.50*	
Bushelings, new fact, prop'd	21.00*	
Bushelings, new fact, unprop'd	16.00*	
Short steel turnings	17.00*	
No. 1 cast	$48.00 to	50.00*
No. 2 cast	44.00 to	45.00*

*Ceiling Price

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LEADERS IN IRON AND STEEL SCRAP SINCE 1889

Comparison of Prices . .

Price advances over previous week are printed in Heavy Type; declines appear in *Italics*.

Steel prices on this page are the average of various f.o.b. quotations of major producing areas: Pittsburgh, Chicago, Gary, Cleveland, Youngstown.

Flat-Rolled Steel:	Jan. 4, 1949	Dec. 28, 1948	Dec. 7, 1948	Jan. 6, 1948
(cents per pound)				
Hot-rolled sheets	3.26	3.26	3.26	2.80
Cold-rolled sheets	4.00	4.00	4.00	3.55
Galvanized sheets (10 ga)	4.40	4.40	4.40	3.95
Hot-rolled strip	3.265	3.265	3.265	2.80
Cold-rolled strip	4.063	4.063	4.063	3.55
Plates	3.42	3.42	3.42	2.95
Plates wrought iron	7.85	7.85	7.85	6.85
Stains C-R strip (No. 302)	33.25	33.25	33.25	30.50
Tin and Terneplate:				
(dollars per base box)				
Tinplate (1.50 lb) cokes	$7.75	$6.80	$6.80	$6.80
Tinplate, electro (0.50 lb)	6.70	6.00	6.00	6.00
Special coated mfg. ternes	6.65	5.90	5.90	5.90
Bars and Shapes:				
(cents per pound)				
Merchant bars	3.37	3.37	3.37	2.90
Cold-finished bars	3.995	3.995	3.995	3.55
Alloy bars	3.75	3.75	3.75	3.30
Structural shapes	3.25	3.25	3.25	2.80
Stainless bars (No. 302)	28.50	28.50	28.50	26.00
Wrought iron bars	9.50	9.50	9.50	7.15
Wire:				
(cents per pound)				
Bright wire	4.256	4.256	4.256	3.55
Rails:				
(dollars per 100 lb)				
Heavy rails	$3.20	$3.20	$3.20	$2.75
Light rails	3.55	3.55	3.55	3.10
Semifinished Steel:				
(dollars per net ton)				
Rerolling billets	$52.00	$52.00	$52.00	$45.00†
Slabs, rerolling	52.00	52.00	52.00	45.00†
Forging billets	61.00	61.00	61.00	55.00†
Alloy blooms, billets, slabs	63.00	63.00	63.00	66.00†
Wire rod and Skelp:				
(cents per pound)				
Wire rods	3.619	3.619	3.619	2.80
Skelp	3.25	3.25	3.25	2.60

† Gross ton

Pig Iron:	Jan. 4, 1949	Dec. 28, 1948	Dec. 7, 1948	Jan. 6, 1948
(per gross ton)				
No. 2, foundry, Phila.	$51.56	$51.56	$51.56	$44.61
No. 2, Valley furnace	46.50	46.50	46.50	39.50
No. 2, Southern Cin'ti	49.47	49.47	49.47	43.28
No. 2, Birmingham	43.38	43.38	43.38	37.38
No. 2, foundry, Chicago†	46.00	46.00	46.00	39.00
Basic del'd Philadelphia	50.76	50.76	50.76	44.11
Basic, Valley furnace	46.00	46.00	46.00	39.00
Malleable, Chicago†	46.50	46.50	46.50	38.50
Malleable, Valley	46.50	46.50	46.50	39.50
Charcoal, Chicago	73.78	73,78	73.78	62.46
Ferromanganese‡	161.71	161.71	161.71	145.00

† The switching charge for delivery to foundries in the Chicago district is $1 per ton.
‡ Average of U. S. prices quoted on Ferroalloy page.

Scrap				
(per gross ton)				
Heavy melt'g steel, P'gh.	$42.75	$42.75	$42.75	$40.00
Heavy melt'g steel, Phila.	44.50	44.50	44.50	40.50
Heavy melt'g steel, Ch'go	41.75	41.75	41.75	39.50
No. 1, hy. comp. sh't, Det.	38.00	38.00	38.00	35.00
Low phos. Young'n	47.75	47.75	47.75	47.25
No. 1, cast, Pittsburgh	*68.00*	69.00	70.00	55.00
No. 1, cast, Philadelphia	*63.50*	65.50	66.50	55.50
No. 1, cast, Chicago	*61.00*	68.50	71.00	63.50
Coke, Connellsville:				
(per net ton at oven)				
Furnace coke, prompt	$17.00	$15.00	$15.00	$12.50
Foundry coke, prompt	17.00	17.00	17.00	14.00
Nonferrous Metals:				
(cents per pound to large buyers)				
Copper, electro, Conn.	23.50	23.50	23.50	21.50
Copper, Lake Conn.	23.625	23.625	23.625	21.625
Tin, Grade A, New York	$1.03	$1.03	$1.03	94.00
Zinc, East St. Louis	17.50	17.50	17.50	10.50
Lead, St. Louis	21.30	21.30	21.30	14.80
Aluminum, virgin	17.00	17.00	17.00	15.00
Nickel, electrolytic	42.90	42.90	42.90	37.67
Magnesium, ingot	20.50	20.50	20.50	20.50
Antimony, Laredo, Tex.	38.50	38.50	38.50	33.00

Composite Prices . .

Starting with the issue of Apr. 22, 1943, the weighted finished steel index was revised for the years 1941, 1942, and 1943. See explanation of the change on p. 90 of the Apr. 22, 1943, issue. Index revised to a quarterly basis as of Nov. 16, 1944; for details see p. 98 of that issue. The finished steel composite price for the current quarter is an estimate based on finished steel shipments for the previous quarter. This figure will be revised when shipments for this quarter are compiled.

	FINISHED STEEL (Base Price)	PIG IRON	SCRAP STEEL
Jan. 4, 1949	3.75628¢ per lb	$46.82 per gross ton	$43.00 per gross ton
One week ago	3.75628¢ per lb	$46.82 per gross ton	$43.00 per gross ton
One month ago	3.75628¢ per lb	$46.82 per gross ton	$43.00 per gross ton
One year ago	3.22566¢ per lb	$39.00 per gross ton	$40.00 per gross ton

	HIGH		LOW		HIGH		LOW		HIGH		LOW	
1948	3.75700¢	July 27	3.22566¢	Jan. 1	$46.82	Oct. 12	$39.58	Jan. 6	$43.16	July 27	$39.75	Mar. 9
1947	3.19541¢	Oct. 7	2.87118¢	Jan. 7	37.98	Dec. 30	30.14	Jan. 7	42.58	Oct. 28	29.50	May 20
1946	2.83599¢	Dec. 31	2.54490¢	Jan. 1	30.14	Dec. 10	25.37	Jan. 1	31.17	Dec. 24	19.17	Jan. 1
1945	2.44104¢	Oct. 2	2.54490¢	Jan. 2	25.37	Oct. 23	23.61	Jan. 2	19.17	Jan. 2	18.92	May 22
1944	2.30837¢	Sept. 5	2.21189¢	Oct. 5	$23.61		$23.61		19.17	Jan. 11	15.76	Oct. 24
1943	2.29176¢		2.29176¢		23.61		23.61		$19.17		$19.17	
1942	2.28249¢		2.28249¢		23.61		23.61		19.17		19.17	
1941	2.43078¢		2.43078¢		$23.61	Mar. 20	$23.45	Jan. 2	$22.00	Jan. 7	$19.17	Apr. 10
1940	2.30467¢	Jan. 2	2.24107¢	Apr. 16	23.45	Dec. 23	22.61	Jan. 2	21.83	Dec. 30	16.04	Apr. 9
1939	2.35367¢	Jan. 3	2.26689¢	May 16	22.61	Sept. 19	20.61	Sept. 12	22.50	Oct. 3	14.08	May 16
1938	2.58414¢	Jan. 4	2.27207¢	Oct. 18	23.25	June 21	19.61	July 6	15.00	Nov. 22	11.00	June 7
1937	2.58414¢	Mar. 9	2.32263¢	Jan. 4	23.25	Mar. 9	20.25	Feb. 16	21.92	Mar. 30	12.67	June 9
1936	2.32263¢	Dec. 28	2.05200¢	Mar. 10	19.74	Nov. 24	18.73	Aug. 11	17.75	Dec. 21	12.67	June 8
1935	2.07642¢	Oct. 1	2.06492¢	Jan. 8	18.84	Nov 5	17.83	May 14	13.42	Dec. 10	10.33	Apr. 29
1934	2.15367¢	Apr. 24	1.95757¢	Jan. 2	17.90	May 1	16.90	Jan. 27	13.00	Mar. 13	9.50	Sept. 25
1933	1.95578¢	Oct. 3	1.75836¢	May 2	16.90	Dec. 5	13.56	Jan. 3	12.25	Aug. 8	6.75	Jan. 3
1932	1.89196¢	July 5	1.83901¢	Mar. 1	14.81	Jan. 5	13.56	Dec. 6	8.50	Jan. 12	6.43	July 5
1931	1.99626¢	Jan. 13	1.86586¢	Dec. 29	15.90	Jan. 6	14.79	Dec. 15	11.33	Jan. 6	8.50	Dec. 29
1930	2.25488¢	Jan. 7	1.97319¢	Dec. 9	18.21	Jan. 7	15.90	Dec. 16	15.00	Feb. 18	11.25	Dec. 9
1929	2.31773¢	May 28	2.26498¢	Oct. 29	18.71	May 14	18.21	Dec. 17	17.58	Jan. 29	14.08	Dec. 8

Weighted index based on steel bars, shapes, plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing major portion of finished steel shipments. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

ALTER
COMPANY

FIFTY YEARS OF SERVICE

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DAVENPORT 2, IOWA

Iron and Steel Prices . . .

Steel prices shown here are f.o.b. producing points in cents per pound unless otherwise indicated. Extras apply. (1) Commercial quality sheet grade; prices, 0.25¢ above base. (2) Commercial quality grade. (3) Widths up to 12-in. inclusive. (4) 0.25 carbon and less. (5) Cokes, 1.25 lb, deduct 25¢ per base box. (6) 18 gage and heavier. (7) For straight length material only from producers to fabricators. (8) Also shafting. For quantities of 40,000 lb and over. (9) Carload lot in manufacturing trade. (10) Hollowware enameling, gages 29 to 31 only. (11) Produced to dimensional tolerances in AISI Manual Sec. 6. (12) Slab prices subject to negotiation in most cases. (13) San Francisco only. (14) Los Angeles only. (15) San Francisco and Los Angeles only. (16) Seattle only. (17) Seattle and Los Angeles only.

PRODUCTS	Base prices at producing points apply to the sizes and grades produced in these areas														
	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio		Detroit	Johnstown	Seattle, S. Frisco, LosAngeles	Fontana
INGOTS Carbon forging	$50.00														
Alloy	$51.00						(per net ton)								
BILLETS, BLOOMS, SLABS Carbon, rerolling[12]	$52.00				$52.00	$52.00	(per net ton)						$52.00		
Carbon forging billets	$61.00	$61.00	$61.00	$61.00	$61.00	$61.00	(per net ton)						$61.00		
Alloy	$63.00	$63.00				$63.00	(Bethlehem, Canton, Massillon = $63.00) (per net ton)								
PIPE SKELP	3.25						3.25				Warren =3.25				
WIRE RODS	3.40 to 4.15	3.40 to 3.90		3.40	3.40		3.65	3.50			Worcester 3.70		3.40	4.05[13] 4.10[14]	
SHEETS Hot-rolled[6]	3.25 to 3.30	3.25	3.25	3.25–3.30	3.25	3.25	3.25	3.25		Warren, Ashland =3.25		3.45		3.95[15]	5.65
Cold-rolled[1]	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.70	4.00	Warren 4.00	4.20		Pittsburg, Cal. 4.95	
Galvanized (10 gage)	4.40	4.40	4.40		4.40			4.40	Canton =4.40	4.40	Ashland =4.40			5.15[15]	
Enameling (12 gage)	4.40	4.40	4.40	4.40			4.40		4.60	4.40		4.70			
Long ternes[2] (10 gage)	4.80		4.80							4.80					
STRIP Hot-rolled[3]	3.25 to 3.30	3.25 to 3.30	3.25	3.25 to 3.30	3.25	3.25	3.25	3.25		3.25	Warren =3.25	3.45		4.00 to 4.25	5.90
Cold-rolled[4]	4.00	4.25		4.00	4.00	4.00	4.00	4.00		New Haven 4.50 Warren=4.00 to 4.25		4.20 to 4.50			7.10
TINPLATE Cokes, 1.50 lb.[5] base box	$7.75	$7.75	$7.75		$7.85			$7.85	$7.95	Warren, Ohio =$7.75				Pittsburg, Cal.=$8.50	
Electrolytic 0.25, 0.50, 0.75 lb. box	Deduct $1.30, $1.05 and 75¢ respectively from 1.50 lb. coke base box price														
TERNES MFG., special coated	Deduct $1.10 from 1.50 lb. coke base box price														
BLACKPLATE CANMAKING 55 to 128 lb.	Deduct $2.00 from 1.50 lb. coke base box price														
BLACKPLATE, h.e., 29 ga.[10]	5.30	5.30	5.30					5.40		Warren, Ohio =5.30					
BARS Carbon Steel	3.35 to 3.55	3.35	3.35	3.35	3.35	3.35	3.35	3.35		3.35	Canton =3.35	3.55	3.35	4.05 to 4.10	5.30
Reinforcing (billet)[7]	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35			Canton =3.35		3.35	4.05 to 4.10	5.30
Cold-finished[8]	3.95 to 4.00	4.00	4.00	4.00		4.00	4.00					4.30			
Alloy, hot-rolled	3.75	3.75	3.75			3.75	3.75	Bethlehem, Canton, Massillon=3.75				4.05	3.75	4.80[14]	5.50
Alloy cold-drawn	4.65 to 4.75	4.65	4.65	4.65		4.65	4.65	Massillon=4.65			Worcester 4.95				
PLATE Carbon steel[11]	3.40 to 3.60	3.40	3.40	3.40 to 3.60	3.40	3.45	3.40 =3.95	3.45 Coatesville=3.75, Claymont=3.95 Geneva=3.40, Harrisburg=6.50				3.65	3.45	4.30[16]	5.80
Floor plates	4.55	4.55		4.55				Conshohocken =4.55							
Alloy	4.40	4.40							Coatesville=5.10						
SHAPES, Structural	3.25 to 3.30	3.25	3.25		3.25	3.30	Bethlehem=3.30, Geneva, Utah=3.25						3.30	3.85 to 4.30	5.75
MANUFACTURERS' WIRE[9] Bright	4.15 to 4.50	4.15 to 4.65		4.15	4.15		4.15	4.25	Duluth=4.15, Worcester=4.45				4.15	5.15[13]	
Spring (high carbon)	5.20	5.20		5.20				5.30	Worcester=5.50 New Haven, Trenton=5.50				5.20	Duluth= 5.20-6.15	
PILING, Steel sheet	4.05	4.05				4.05									

STAINLESS STEELS

Base prices, in cents per pound, f.o.b. producing point

Product	Chromium Nickel 301	302	303	304	316	347	Straight Chromium 410	416	430
Ingots, rerolling	12.75	13.50	15.00	14.50	22.75	20.00	11.25	13.75	11.50
Slabs, billets, rerolling	17.00	18.25	20.25	19.25	30.25	26.75	15.00	18.50	15.25
Forging discs, die blocks, rings	30.50	30.50	33.00	32.00	49.00	41.00	24.50	25.00	25.00
Billets, forging	24.25–26.50	24.25–26.50	26.25–28.75	25.50–27.75	39.00–42.75	32.75–35.75	19.50–21.50	20.00–21.75	20.00–21.75
Bars, wire, structurals	28.50	28.50	31.00	30.00	46.00	38.50	23.00	23.50	23.50
Plates	32.00	32.00	34.00	34.00	50.50	44.00	26.00	26.50	26.50
Sheets	37.50–40.75	37.50–40.75	39.50–43.00	39.50–43.00	53.00–57.25	50.00–54.00	33.00	33.50	35.50 .....
Strip, hot-rolled	24.25	25.75	30.00	27.75	46.00	38.75	21.25	28.00	21.75
Strip, cold-rolled	30.50–30.75	33.00–33.50	36.50–39.50	35.00–35.75	55.00–57.25	48.50–50.00	27.00	33.50	27.50 .....

ELECTRODES

Cents per lb, f.o.b. plant, threaded electrodes with nipples, unboxed

Diameter in in.	Length in in.	
Graphite		
17, 18, 20	60, 72	16.00¢
8 to 16	48, 60, 72	16.50¢
7	48, 60	17.75¢
6	48, 60	19.00¢
4, 5	40	19.50¢
3	40	20.50¢
2½	24, 30	21.00¢
2	24, 30	23.00¢
Carbon		
40	100, 110	7.50¢
35	65, 110	7.50¢
30	65, 84, 110	7.50¢
24	72 to 104	7.50¢
17 to 20	84, 90	7.50¢
14	60, 72	8.00¢
10, 12	60	8.25¢
8	60	8.50¢

TOOL STEEL

F.o.b. mill

W	Cr	V	Mo	Co	Base per lb
18	4	1	—	—	90.5¢
18	4	1	—	5	$1.42
18	4	2	—	—	$1.025
1.5	4	1.5	8	—	65¢
6	4	2	6	—	69.5¢

High-carbon-chromium ..... 52¢
Oil harden manganese ..... 29¢
Special carbon ..... 26.5¢
Extra carbon ..... 22¢
Regular carbon ..... 19¢

Warehouse prices on and east of Mississippi are 2½¢ per lb higher. West of Mississippi, 4½¢ higher.

ELECTRICAL SHEETS

Base, HR cut lengths, f.o.b. mill

	Cents per lb
Armature	5.45
Electrical	5.95
Motor	6.70 to 9.20
Dynamo	7.50 to 10.00
Transformer 72	8.05 to 11.80
Transformer 65	8.60 to 12.35
Transformer 58	9.30 to 13.05
Transformer 52	10.10

RAILS, TRACK SUPPLIES

F.o.b. mill

Standard rails, 100 lb and heavier, No. 1 quality, per 100 lb ..... $3.20†
Joint bars, 100 lb 4.25
Light rails (from billets) per 100 lb 3.55

	Base Price cents per lb
Track spikes	5.35
Axles	5.20
Screw spikes	8.00
Tie plates	4.05
Tie plates, Pittsburg, Calif.*	4.20
Track bolts, untreated	8.25
Track bolts, heat treated, to railroads	8.50

*Seattle, add 30¢.
CF&I and Inland, $3.50.

C-R SPRING STEEL

Base per pound f.o.b. mill

0.26 to 0.40 carbon	4.00¢
0.41 to 0.60 carbon	5.50¢
0.61 to 0.80 carbon	6.10¢
0.81 to 1.05 carbon	8.05¢
1.06 to 1.35 carbon	10.35¢

Worcester, add 0.30¢.

CLAD STEEL

Base prices, cents per pound

	Plate	Sheet
Stainless clad		
No. 304, 20 pct, f.o.b.		
Coatesville, Pa.	*26.50	
Washington, Pa.	*26.50	*22.50
Claymont, Del.	*26.50	
Conshohocken, Pa.		*22.50
Nickel-clad		
10 pct f.o.b. Coatesville, Pa.	27.50	
Inconel-clad		
10 pct, f.o.b. Coatesville.	36.00	
Monel-clad		
10 pct, f.o.b. Coatesville.	29.00	
Alumnized steel sheets		
Hot dip, 20 gage, f.o.b. Butler, Pa.	....	9.25

* Includes annealing and pickling, or sandblasting.

MERCHANT WIRE PRODUCTS

To the dealer, f.o.b. mill

	Base	Column Pittsburg, Calif.
Standard & coated nails*	103	123
Galvanized nails*	103	123
Woven wire fence†	109	132
Fence posts, carloads††	114	...
Single loop bale ties	106	130
Galvanized barbed wire**	123	143
Twisted barbless wire	123	...

* Pgh., Chi., Duluth; Worcester, 6 columns higher. † 15½ gage and heavier. ** On 80 rod spools, in carloads. †† Duluth only.

	Base per 100 lb	Pittsburg, Calif.
Annealed fence wire‡	$4.80	$5.75
Annealed, galv. fencing‡	5.25	6.20
Cut nails, carloads‡‡	6.75	....

‡ Add 30¢ at Worcester; 10¢ at Sparrows Pt.
‡‡ Less 20¢ to jobbers.

HIGH STRENGTH, LOW ALLOY STEELS

Mill base prices, cents per pound

Steel	Aldecor	Corten	Double Strength No. 1	Dyn-alloy	HI Steel	Mayari R	Otis-coloy	Yoloy	NAX High Tensile
Producer	Republic	Carnegie-Illinois, Republic	Republic	Alan Wood	Inland	Bethlehem	Jones & Laughlin	Youngstown Sheet & Tube	Great Lakes Steel
Plates	5.20	5.20	5.20	5.30	5.20	5.30	5.20	5.40	5.65
Sheets									
Hot-rolled	4.95	4.95	4.95	5.25	4.95	4.95	4.95	5.15	5.25
Cold-rolled	6.05	6.05	6.05	....	6.05	6.05	6.05	6.25	6.35
Galvanized	....	6.75	....	....	....	6.75	....	....	....
Strip									
Hot-rolled	4.95	4.95	4.95	....	4.95	4.95	4.95	5.15	5.25
Cold-rolled	....	....	6.05	....	....	6.05	6.05	....	6.35
Shapes	....	4.95	....	....	4.95	5.05	4.95	....	....
Beams	....	4.95	....	....	....	....	....	....	....
Bars									
Hot-rolled	5.10	5.10	5.10	....	5.10	5.10	5.10	....	5.40
Bar shapes	....	5.10	....	....	5.10	5.10	5.10	....	....

PIPE AND TUBING

Base discounts, f.o.b. mills, Base price, $200.00 per net ton.

STANDARD, THREADED AND COUPLED

	Black	Galv.
Steel, buttweld		
½-in.	43 to 41	20 to 18
¾-in.	46 to 44	24 to 22
1-in.	48½ to 46½	27 to 25
1¼-in.	49 to 47	27½ to 25½
1½-in.	49½ to 47½	28 to 26
2-in.	50 to 48	28½ to 26½
2½ to 3-in.	50½ to 49½	29 to 27
Steel, lapweld		
2-in.	39½	17½
2½ to 3 in.	39½	21½
3½ to 6 in.	46½ to 42	20½ to 24½
Steel, seamless		
2-in.	38½ to 27	16½ to 5
2½ to 3-in	41½ to 35	19½ to 10½
3½ to 6-in.	43½ to 38½	21½ to 16½
Wrought Iron, buttweld		
½-in.	+20½	+52½
¾-in.	+10½	+41½
1 & 1¼-in.	+ 4½	+32½
2-in.	— 1½	+29
3-in.	— 2	+28½
Wrought Iron, lapweld		
2-in.	+ 7½	+36½
2½ to 3½-in.	+ 5	+32
4-in.	list	+26
4½ to 8-in.	+ 2	+27½

EXTRA STRONG, PLAIN ENDS

Steel, buttweld		
½-in.	42 to 40	20½ to 18½
¾-in.	46 to 44	24½ to 22½
1-in.	48 to 46	27½ to 25½
1¼-in.	48½ to 46½	28 to 26
1½-in.	49 to 47	28½ to 26½
2-in.	49½ to 47½	29 to 27
2½ to 3-in.	50 to 48	29½ to 27½
Steel, lapweld		
2-in.	39½	18½
2½ to 3-in.	44½	23½
3½ to 6-in.	48 to 44	23 to 27
Steel, seamless		
2-in.	37½ to 32½	16½ to 11½
2½ to 3-in.	41½ to 36½	20½ to 15½
3½ to 6-in.	45	24
Wrought Iron, buttweld		
½-in.	+16	+46½
¾-in.	+ 9½	+39½
1 to 2-in.	— 1½	+28½
Wrought Iron, lapweld		
2-in.	+ 4½	+33
2½ to 4-in.	— 5	+21½
4½ to 6-in.	— 1	+26

For threads only, buttweld, lapweld and seamless pipe, one point higher discount (lower price) applies. For plain ends, buttweld, lapweld and seamless pipe 3-in. and smaller, three points higher discount (lower price) applies, while for lapweld and seamless 3½-in. and larger four points higher discount (lower price) applies. On buttweld and lapweld steel pipe, jobbers are granted a discount of 5 pct. On l.c.l. shipments, prices are determined by adding 25 pct and 30 pct and the carload freight rate to the base card.

BOILER TUBES

Seamless steel and electric welded commercial boiler tubes and locomotive tubes, minimum wall. Prices per 100 ft at mill in carload lots, cut length 4 to 24 ft inclusive.

OD in in.	Gage BWG	Seamless H.R.	Seamless C.R.	Electric Weld H.R.	Electric Weld C.D.
2	13	19.18	22.56	18.60	21.89
2½	12	25.79	30.33	25.02	29.41
3	12	28.68	33.76	27.82	32.74
3½	11	35.85	42.20	34.78	40.94
4	10	44.51	52.35	43.17	50.78

CAST IRON WATER PIPE

Per net ton

6 to 24-in., del'd Chicago $106.70
6 to 24-in., del'd N. Y.....103.50 to 108.40
6 to 24-in., Birmingham 93.50
6-in. and larger, f.o.b. cars, San Francisco, Los Angeles, for all rail shipment; rail and water shipment less 120.30

Class "A" and gas pipe, $5 extra; 4-in. pipe is $5 a ton above 6-in.

BOLTS, NUTS, RIVETS, SET SCREWS

Consumer Prices

(Bolts and nuts f.o.b. mill Pittsburgh, Cleveland, Birmingham or Chicago)

Base discount less case lots

Machine and Carriage Bolts

	Pct Off List
½ in. & smaller x 6 in. & shorter	35
9/16 & ⅝ in. x 6 in. & shorter	37
¾ in. & larger x 6 in. & shorter	34
All diam, longer than 6 in.	30
Lag, all diam over 6 in. longer	35
Lag, all diam x 6 in. & shorter	37
Plow bolts	47

Nuts, Cold Punched or Hot Pressed

(Hexagon or Square)

½ in. and smaller	35
9/16 to 1 in. inclusive	34
1⅛ to 1½ in. inclusive	32
1⅝ in. and larger	27

On above bolts and nuts, excepting plow bolts, additional allowance of 15 pct for full container quentities. There is an additional 5 pct allowance for carload shipments.

Semifinished Hexagon Nuts

	USS	SAE
7/16 in. and smaller	..	41
½ in. and smaller	38	..
½ in. through 1 in.	..	39
9/16 in. through 1 in.	37	..
1⅛ in. through 1½ in.	35	37
1⅝ in. and larger	28	..

In full case lots, 15 pct additional discount.

Stove Bolts

Packages, nuts separate	$61.75
In bulk	70.00

Large Rivets

(½ in. and larger)
Base per 100 lb

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$6.75
F.o.b. Lebanon, Pa.	6.75

Small Rivets

(7/16 in. and smaller)
Pct off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	48

Cap and Set Screws

(In packages)	*Pct Off List*
Hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in., SAE 1020, bright	46
¾ to 1 in. x 6 in., SAE (1035), heat treated	35
Set screws, oval points	
Milled studs	19
Flat head cap screws, listed sizes	5
Fillister head cap, listed sizes	28

FLUORSPAR

Washed gravel fluorspar, f.o.b. cars, Rosiclare, Ill.

Effective CaF, Content:	*Base price per net ton*
70% or more	$37.00
60% or less	34.00

LAKE SUPERIOR ORES

(51.50% Fe, Natural Content, Delivered Lower Lake Ports)

	Per Gross Ton
Old range, Bessemer	$6.60 to $7.60
Old range, nonbessemer	6.45 to 7.45
Mesabi, bessemer	6.35 to 7.35
Mesabi, nonbessemer	6.20 to 7.20
High phosphorus	6.20 to 7.20

After Dec. 31, 1948, increases or decreases in Upper Lake freight handling charges or taxes thereon to be for the buyers' account.

METAL POWDERS

Per pound, f.o.b. shipping point, in ton lots, for minus 100 mesh.

Swedish sponge iron c.i.f. New York, ocean bags	7.9¢ to 9.0¢
Domestic sponge iron, 98+% Fe, carload lots	9.0¢ to 15.0¢
Electrolytic iron, annealed, 99.5+% Fe	19.5¢ to 39.5¢
Electrolytic iron, unannealed, minus 325 mesh, 99+% Fe	48.5¢
Hydrogen reduced iron, minus 300 mesh, 98+% Fe	63.0¢ to 80.0¢
Carbonyl iron, size 5 to 10 microns, 98%, 99.8%+ Fe.	90.0¢ to $1.75
Aluminum	30.00¢
Antimony	51.17¢
Brass, 10 ton lots	27.25 to 37.25¢
Copper, electrolytic	33.625¢
Copper, reduced	34.25¢
Cadmium	$2.55
Chromium, electrolytic, 99% min.	$3.50
Lead	27.80¢
Manganese	55.00¢
Molybdenum, 99%	$2.65
Nickel, unannealed	66.00¢
Nickel, spherical, minus 30 mesh, unannealed	68.00¢
Silicon	34.00¢
Solder powder	8.5¢ plus metal cost
Stainless steel, 302	75.0¢
Tin	$1.155
Tungsten, 99%	$2.90
Zinc, 10 ton lots	17.75 to 22.25¢

COKE

	Net Ton
Furnace, beehive (f.o.b. oven) Connellsville, Pa.	$16.00 to $18.00
Foundry, beehive (f.o.b. oven) Connellsville, Pa.	$16.00 to $18.00
Foundry, Byproduct	
Buffalo	$22.75 to $23.10
Chicago, del'd	23.90
Chicago, f.o.b.	20.85
Detroit, f.o.b.	19.40
New England, del'd	22.75
Seaboard, N. J., f.o.b.	21.50
Philadelphia, f.o.b.	20.55
Swedeland, Pa. f.o.b.	20.50
Painesville, Ohio, f.o.b.	20.90
Erie, del'd	19.95
Cleveland, del'd	22.45
Cincinnati, del'd	21.40
St. Paul, del'd	23.17
St. Louis, del'd	20.98
Birmingham, del'd	18.66

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick	*Carloads, Per 1000*
First quality, Pa., Md., Ky., Mo. (except Salina, Pa., add $5)	$80.00
No. 1 Ohio	74.00
Sec. quality, Pa., Md., Ky., Mo.	74.00
No. 2 Ohio	66.00
Ground fire clay, net ton, bulk (except Salina, Pa., add $1.50)	11.50
Silica Brick	
Mt. Union, Pa., Ensley, Ala.	$80.00
Childs, Pa.	84.00
Hays, Pa.	85.00
Chicago District	89.00
Western, Utah and Calif.	95.00
Super Duty, Hays, Pa., Athens, Tex.	85.00
Silica cement, net ton, bulk, Eastern (except Hays, Pa.)	$13.75 to 14.00
Silica cement, net ton, bulk, Hays, Pa.	16.00
Silica cement, net ton, bulk, Ensley, Ala.	15.00
Silica cement, net ton, bulk, Chicago District	14.75
Silica cement, net ton, bulk, Utah and Calif.	21.00
Chrome Brick	*Per Net Ton*
Standard chemically bonded, Balt., Chester	$69.00
Magnesite Brick	
Standard, Balt. and Chester	$91.00
Chemically bonded, Balt. and Chester	80.00
Grain Magnesite	*Std. ⅜-in. grains*
Domestic, f.o.b. Balt. and Chester, in bulk, fines removed	$56.50
Domestic, f.o.b. Chewelah, Wash., in bulk with fines	$30.50 to 31.00
in sacks with fines	35.00 to 35.50
Dead Burned Dolomite	
F.o.b. producing points in Pennsylvania, West Virginia and Ohio, per net ton, bulk. Midwest, add 10¢; Missouri Valley, add 20¢	$12.25

WAREHOUSE PRICES

Base prices, f.o.b. warehouse, per 100 lb.
(Metropolitan area delivery, add 15¢ to base, except New York, add 20¢)

CITIES	SHEETS			STRIP		PLATES	SHAPES	BARS		ALLOY BARS			
	Hot-Rolled	Cold-Rolled (16 gage)	Galvanized (16 gage)	Hot-Rolled	Cold-Rolled		Standard Structural	Hot-Rolled	Cold-Finished	Hot-Rolled, A 4615 As-rolled	Hot-Rolled, A 4140-50 Ann.	Cold-Drawn, A 4615 As-rolled	Cold-Drawn, A 4140-50 Ann.
Philadelphia	$5.15- 5.71	$6.31- 6.57	$7.27- 7.52	$5.35- 5.66	$6.51	$5.37- 5.52	$5.09- 5.24	$5.35- 5.57	$6.16- 6.31	$9.14	$9.29	$10.54	$10.69
New York	5.40- 5.98	6.28- 6.43	7.25- 7.89	5.58- 5.88	6.48- 6.73	5.78	5.32- 5.58	5.53- 5.63	6.18- 6.38	9.17- 9.53	9.32- 9.68	10.40- 10.77	10.55- 10.92
Boston	5.48- 5.64	6.39	7.56- 7.83	5.54- 5.89	6.75- 6.79	5.74	5.39- 5.54	5.48- 5.59	6.24- 6.34	9.40- 9.44	9.55- 9.59	10.84- 10.94	10.92- 11.09
Baltimore	5.28	6.18	7.15- 7.38	5.34	....	5.53	5.33- 5.39	5.39	6.13	....	....	....	....
Chicago	4.85- 5.10	5.75- 5.95	7.15- 7.30	4.85- 5.30	6.15	5.10	4.90	4.90	5.70	9.35	9.60	10.80	11.05
Milwaukee	5.02- 5.07	5.92	7.12- 7.47	5.02- 5.37	6.32	5.22- 5.27	5.07	5.07	5.87	9.15- 9.17	9.32	10.52- 10.57	10.67- 10.72
Norfolk	5.75	....	....	....	....	6.00	6.00	6.00	....	....	....	....	....
Cleveland	4.98- 5.20	5.75[1]- 6.04[1]	7.18- 7.44	5.02- 5.65	6.70	5.35- 5.54	5.16- 5.42	5.15- 5.34	5.70- 5.95	9.14- 9.66	9.29- 9.89	11.05	11.30 ....
Buffalo	4.85	5.75	7.65	5.56	6.35	5.35	5.10	5.05	5.90	9.70	9.95	11.15	11.40
Detroit	5.20- 5.55	6.05- 6.50	7.70	5.25- 5.70	6.25- 6.55	5.50- 5.55	5.30- 5.37	5.30- 5.52	6.02- 6.07	9.31- 9.55	9.20- 9.47	10.72- 10.95	10.87- 11.10
Cincinnati	5.14- 5.36[8]	5.82- 6.21[8]	6.97- 7.65	5.25- 5.62[8]	6.31	5.50- 5.71[8]	5.30- 5.47[8]	5.30- 5.62[8]	6.06- 6.17[8]	9.31- 9.35	9.50- 9.51	10.75- 10.76	10.90- 10.91
St. Louis	5.19	6.04- 6.09	7.29- 7.64	5.18- 5.79	6.49	5.39- 5.44	5.24	5.24	6.04	9.69	9.94	11.14	11.39
Pittsburgh	4.85- 4.90	5.75[1]	7.15	5.00- 5.35	5.95	5.05- 5.25	4.90- 5.15	4.90- 5.10	5.65- 5.80	9.35	9.60	10.40	10.55- 10.80
St. Paul	5.41	6.31	7.30- 7.71	5.41	....	5.66	5.46	5.46	6.26	9.91	10.10	11.36	11.61
Omaha	5.92	....	9.18	5.92	....	6.17	5.97	5.97	6.77	....	....	....	....
Birmingham	5.05[1]	6.36	6.45	5.05[11]	6.36	5.25[11]	5.00[11]	5.00[11]	6.66	....	....	....	....
Houston	6.40	....	8.80	6.75	....	6.35	6.20	6.40	7.60	9.80	9.65	10.75	10.95
Los Angeles	6.30- 6.40	7.85[1]- 7.90	7.95- 8.90	6.60- 6.66	9.35[5]	6.10- 7.40	5.75- 5.90	6.05	7.85[15]- 8.45	10.90	10.85	12.40	12.65
San Francisco	5.95[5]	7.15[2]	8.25- 8.90	6.75[5]	8.25	6.30- 7.60	5.90- 6.90	5.90	7.55	10.90	10.85	12.40	12.65
Portland	6.50[4]	8.00[2]	8.15[2] 8.45[2]	6.85[4]	....	6.30[4]	6.25[4]	6.25[4]	8.25[4]	....	10.45[15]	....	12.05[15]
Seattle	6.20[4]- 6.30[4]	7.75[2]- 7.85[2]	7.65 8.00	6.55[4]- 6.65[4]	....	6.20- 6.30	6.15- 6.25	6.05[4]- 6.15[4]	8.00[14]- 8.10[14]	....	10.30[15]- 10.40[15]	....	12.00[15]- 12.05[15]
Salt Lake City	7.05- 8.00	8.20	7.90- 9.06	7.10- 7.59	....	5.75- 6.65	6.65- 7.00	6.95- 7.25	7.55- 8.40	....	....	....	....

BASE QUANTITIES

Standard unless otherwise keyed on prices.

HOT-ROLLED:

Sheets, strip, plates, shapes and bars, 400 to 1999 lb.

COLD-ROLLED:

Sheets, 400 to 1999 lb; strip, extras on all quantities bars 1000 lb and over.

ALLOY BARS:

1000 to 1999 lb.

GALVANIZED SHEETS:

450 to 1499 lb.

EXCEPTIONS:

(1) 400 to 1499 lb; (2) 450 to 1499 lb; (3) 300 to 4999 lb; (4) 300 to 9999 lb; (5) 2000 lb and over; (6) 1000 lb and over; (7) 400 to 14,999 lb; (8) 400 lb and over; (9) 500 to 1999 lb; (10) 500 to 999 lb; (11) 400 to 3999 lb; (12) 450 to 3749 lb; (13) 400 to 1999 lb; (14) 1500 lb and over; (15) 1000 to 4999 lb; (16) 4000 lb and over; (17) up to 1999 lb.

PIG IRON PRICES

Dollars per gross ton. Delivered prices represent minimums. Delivered prices do not include 3 pct tax on freight.

PRODUCING POINT PRICES

Producing Point	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Bethlehem	48.00	.....	.....	.....	.....
Birmingham	42.88	43.38	.....	.....	.....
Buffalo	47.00- 48.00*	47.00- 48.00*	47.50- 48.50*	.....	.....
Chicago	46.00	46.50	46.50	47.00	.....
Cleveland	46.00	46.50	46.50	47.00	51.00
Duluth	46.00	46.50	46.50	47.00	.....
Erie	46.00	46.50	46.50	47.00	.....
Everett	.....	52.75	53.25	.....	.....
Granite City	47.90	48.40	48.90	.....	.....
Ironton, Utah	62.00	62.50	.....	.....	.....
Lone Star, Texas	.....	75.00†	.....	.....	.....
Neville Island	46.00	46.50	46.50	.....	.....
Provo	46.00	46.50	.....	.....	.....
Sharpsville	46.00	46.50	46.50	47.00	.....
Steelton	48.00	48.50	49.00	49.50	54.00
Struthers, Ohio	46.00	.....	.....	.....	.....
Swedeland	50.00	50.50	51.00	51.50	.....
Toledo	46.00	46.50	46.50	47.00	.....
Troy, N. Y.	.....	.....	.....	.....	54.00
Youngstown	46.00	46.50	46.50	.....	.....

DELIVERED PRICES† (BASE GRADES)

Consuming Point	Producing Point	Freight Rate	Basic	No. 2 Foundry	Malleable	Bessemer	Low Phos.
Boston	Everett	$0.50 Arb.	.....	52.75	53.25	.....	....
Boston	Steelton	6.27	54.27	54.77	55.27	55.77	60.27
Brooklyn	Bethlehem	3.90	51.90	.....	.....	.....	....
Cincinnati	Birmingham	6.09	48.97	49.47	.....	.....	....
Jersey City	Bethlehem	2.39	50.39	.....	.....	.....	.....
Los Angeles	Provo	6.93	52.93	53.43	.....	.....	.....
Mansfield	Cleveland-Toledo	3.03	49.03- 48.53	49.53- 49.03	49.53	50.03	54.03 .....
Philadelphia	Bethlehem	2.21	50.21	.....	.....	.....	.....
Philadelphia	Swedeland	1.31	51.31	51.81	52.31	52.81	.....
Philadelphia	Steelton	2.81	50.81	51.31	51.81	52.31	56.81
San Francisco	Provo	6.93	52.93	53.43	.....	.....	....
Seattle	Provo	6.93	52.93	53.43	.....	.....	....
St. Louis	Granite City	0.75 Arb.	48.65	49.15	49.65	.....	.....

* Republic Steel Corp. price: Basis: pig iron at Buffalo set by average price of No. 1 hvy. mlt. steel scrap at Buffalo as shown in last week's issue of THE IRON AGE. Price is effective until next Sunday midnight.
† Low Phos, Southern Grade.

Producing point prices are subject to switching charges; silicon differential (not to exceed 50¢ per ton for each 0.25 pct silicon content in excess of base grade which is 1.75 to 2.25 pct); phosphorus differentials, a reduction of 88¢ per ton for phosphorus content of 0.70 pct and over; manganese differentials, a charge not to exceed 50¢ per ton for each 0.50 pct manganese content in excess of 1.00 pct. $2 per ton extra may be charged for 0.5 to 0.75 pct nickel content and $1 per ton extra for each additional 0.25 pct nickel.

Silvery iron (blast furnace) silicon 6.00 to 6.50 pct. C/L per g.t., f.o.b. Jackson, Ohio —$59.50; f.o.b. Buffalo $60.75. Add $1.25 per ton for each additional 0.50 pct Si. up to 12 pct. Add 50¢ per ton for each 0.50 pct Mn over 1.00 pct. Add $1.00 per ton for 0.75 pct or more P. Bessemer ferrosilicon prices are $1.00 per ton above silvery iron prices of comparable analysis.

Charcoal pig iron base price for low phosphorus $66.00 per gross ton, f.o.b. Lyles, Tenn. Delivered Chicago, $73.78. High phosphorus charcoal pig iron is not being produced.

Ferromanganese

78-82% Mn, Maximum contract base price, gross ton, lump size.

F.o.b. Birmingham	$162
F.o.b. Niagara Falls, Alloy, W. Va., Welland, Ont.	$160
F.o.b. Johnstown, Pa.	$162
F.o.b. Sheridan, Pa.	$160
F.o.b. Rockwood, Tenn.	$165
F.o.b. Etna, Pa.	$163

$2.00 for each 1% above 82% Mn; penalty, $2.00 for each 1% below 78%.

Briquets—Cents per pound of briquet, delivered, 66% contained Mn.

Carload, bulk	10.0
Ton lots	11.6
Less ton lots	12.5

Spiegeleisen

Contract prices gross ton, lump, f.o.b.

	16-19% Mn 3% max. Si	19-21% Mn 3% max. Si
Palmerton, Pa.	$61.00	$62.00
Pgh. or Chicago	65.00	66.00

Manganese Metal

Contract basis, 2 in. x down, cents per pound of metal, delivered.

96% min. Mn, 0.2% max. C, 1% max. Si, 2% max. Fe.

Carload, packed	35.5
Ton lots	37.0

Electrolytic Manganese

F.o.b. Knoxville, Tenn., freight allowed east of Mississippi, cents per pound.

Carloads	32
Ton lots	34
Less ton lots	36

Low-Carbon Ferromanganese

Contract price, cents per pound Mn contained, lump size, delivered.

	Carloads	Ton	Less
0.07% max. C. 0.06% P. 90% Mn.	25.25	27.10	28.30
0.10% max. C	24.75	26.60	27.80
0.15% max. C	24.25	26.10	27.30
0.30% max. C	23.75	25.60	26.80
0.50% max. C	23.25	25.10	26.30
0.75% max. C, 7.00% max. Cl	20.25	22.10	23.30

Silicomanganese

Contract basis, lump size, cents per pound of metal, delivered, 65-68% Mn, 18-20% Si, 1.5% max. C.

Carload bulk	8.60
Ton lots	10.25
Briquet, contract basis, carlots, bulk delivered, per lb of briquet	10.0
Ton lots	11.6
Less ton lots	12.5

Silvery Iron (electric furnace)

Si 14.01 to 14.50 pct., f.o.b. Keokuk, Iowa, openhearth $84.00, foundry, $85.00; $84.75 f.o.b. Niagara Falls; Electric furnace silvery iron is not being produced at Jackson. Add $1.00 per ton for each additional 0.50% Si up to and including 18%. Add $1.00 for each 0.50 pct. Mn over 1 pct.

Silicon Metal

Contract price, cents per pound contained Si, lump size, delivered, for ton lots packed.

96% Si, 2% Fe	20.70
97% Si, 1% Fe	21.10

Silicon Briquets

Contract price, cents per pound of briquet, bulk, delivered, 40% Si, 1 lb Si briquets.

Carload, bulk	6.30
Ton lots	7.90
Less ton lots	8.80

Electric Ferrosilicon

Contract price, cents per pound contained Si, lump size, bulk, in carloads, delivered.

25% Si.	18.50
50% Si	11.30
75% Si.	13.50
85% Si	14.65
90-95% Si	16.50

Calcium Metal

Eastern zone contract prices, cents per pound of metal, delivered.

	Cast	Turnings	Distilled
Ton lots	$2.05	$2.95	$3.75
Less ton lots	2.40	3.30	4.55

Ferrochrome

Contract prices, cents per pound, contained Cr, lump size, bulk, in carloads, delivered. (65-72% Cr, 2% max. Si)

0.06% C	28.75
0.10% C	28.25
0.15% C	28.00
0.20% C	27.75
0.50% C	27.50
1.00% C	27.25
2.00% C	27.00
65-69% Cr, 4-9% C	20.50
62-66% Cr, 4-6% C, 6-9% Si	21.35

Briquets — Contract price, cents per pound of briquet, delivered, 60% chromium.

Carload, bulk	13.75
Ton lots	15.25
Less ton lots	16.15

High-Nitrogen Ferrochrome

Low-carbon type: 67-72% Cr, 0.75% N. Add 5¢ per lb to regular low carbon ferrochrome price schedule. Add 5¢ for each additional 0.25% N.

S. M. Ferrochrome

Contract price, cents per pound chromium contained, lump size, delivered.

High carbon type: 60-65% Cr, 4-6% Si, 4-6% Mn, 4-6% C.

Carload	21.60
Ton lots	23.75
Less ton lots	25.25

Low carbon type: 62-66% Cr, 4-6% Si, 4-6% Mn, 1.25% max. C.

Carload	27.75
Ton lots	30.05
Less ton lots	31.85

Chromium Metal

Contract prices, cents per lb. chromium contained packed, delivered, ton lots. 97% min. Cr. 1% max. Fe.

0.20% max. C.	1.09
0.50% max. C.	1.05
9.00% min. C.	1.04

Calcium—Silicon

Contract price per lb. of alloy, lump, delivered.

30-33% Ca, 60.65% Si, 3.00% max. Fe.

Carloads	17.90
Ton lots	21.00
Less ton lots	22.50

Calcium—Manganese—Silicon

Contract prices, cents per lb of alloy, lump, delivered.

16-20% Ca, 14-18% Mn, 53-59% Si.

Carloads	19.25
Ton lots	21.55
Less ton lots	22.55

CMSZ

Contract price, cents per pound of alloy, delivered.

Alloy 4: 45-49% Cr, 4-6% Mn, 18-21% Si, 1.25-1.75% Zr, 3.00-4.5% C.

Alloy 5: 50-56% Cr, 4-6% Mn, 13.50-16.00% Si, 0.75 to 1.25% Zr, 3.50-5.00% C.

Ton lots	19.75
Less ton lots	21.00

V Foundry Alloy

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max, St. Louis. V-5: 38-42% Cr, 17-19% Si, 8-11% Mn.

Ton lots	15.75¢
Less ton lots	17.00¢

Graphidox No. 4

Cents per pound of alloy, f.o.b. Suspension Bridge, N. Y., freight allowed, max. St. Louis. Si 48 to 52%, Ti 9 to 11%, Ca 5 to 7%.

Ton lots and carload packed	18.00¢
Less ton lots	19.50¢

SMZ

Contract price, cents per pound of alloy, delivered. 60-65% Si, 5-7 Mn, 5-7% Zr, 20% Fe, ½ in. x 12 mesh.

Ton lots	17.25
Less ton lots	18.50

Other Ferroalloys

Ferrotungsten, standard, lump or ¼ x down, packed, per pound contained W, 5 ton lots, delivered	$2.25
Ferrovanadium, 35-55%, contract basis, delivered, per pound, contained, V.	
Openhearth	$2.90
Crucible	3.00
High speed steel (Primos)	3.10
Vanadium pentoxide, 88-92% V_2O_5 contract basis, per pound Contained V_2O_5	$1.20
Ferrocolumbium, 50-60% contract basis, delivered, per pound contained Cb.	
Ton lots	$2.90
Less ton lots	2.95
Ferromolybdenum, 55-75%. f.o.b. Langeloth, Pa., per pound contained Mo.	$1.10
Calcium molybdate, 45-50%, f.o.b. Langeloth, Pa., per pound contained Mo.	96¢
Molybdenum oxide briquets, f.o.b. Langeloth, Pa., per pound contained Mo.	95¢
Molybdic oxide in bags, f.o.b. Langeloth, Pa., per pound contained Mo.	95¢
Ferrotitanium, 40-45%, 0.10% C max., f.o.b. Niagara Falls, N. Y., ton lots, per pound contained Ti	$1.23
Ferrotitanium, 20-25%, 0.10% C max., ton lots, per pound contained Ti	$1.40
Less ton lots	1.45
High carbon ferrotitanium, 15-20%, 6-8% C, contract basis, f.o.b. Niagara Falls, freight allowed, carloads, per net ton	$160.00
Ferrophosphorus, electrolytic, 23-26%, carlots, f.o.b. Siglo, Mt. Pleasant, Tenn., $3 unitage, per gross ton	$65.00
10 tons to less carload	75.00
Zirconium, 35-40%, contract basis, f.o.b. plant, freight allowed, per pound of alloy.	
Ton lots	21.00¢
Zirconium, 12-15%, contract basis, lump, delivered, per pound of alloy.	
Carload, bulk	6.60¢
Alsifer, 20% Al, 40% Si, 40% Fe, contract basis, f.o.b. Suspension Bridge, N. Y.	
Carload	8.40¢
Ton lots	9.30¢
Simanal, 20% Si, 20% Mn, 20% Al, contract basis, f.o.b. Philo, Ohio, freight allowed, per pound	
Carload, bulk	11.00
Ton lots, packed	11.25
Less ton lots	11.75

Boron Agents

Contract prices per pound of alloy, delivered.

Ferroboron, 17.50% min. B, 1.50% max Si, 0.50% max. Al, 0.50% max. C, 1 in x D.	
Ton lot	$1.20
Manganese—Boron 75.00% Mn, 15-20% B, 5% max. Fe, 1.50% max. Si, 3.00% max. C, 2 in. X D, delivered.	
Ton lots	$1.67
Less ton lots	1.79
Nickel—Boron 15-18% B, 1.00% max. Al, 1.50% max. Si, 0.50% max. C, 3.00% max. Fe, balance Ni, delivered.	
Less ton lots	$1.80
Silcaz, contract basis, delivered.	
Ton lots	45.00¢
Grainal, f.o.b. Bridgeville, Pa., freight allowed, 100 lb and over.	
No. 1	93¢
No. 6	63¢
No. 79	45¢
Bortam, f.o.b. Niagara Falls	
Ton lots, per pound	45¢
Less ton lots, per pound	50¢
Carbortam, f.o.b. Suspension Bridge, N. Y., freight allowed, Ti 15-18%, B 1.00-1.50%, Si 2.5-3.0%, Al 1.0-2.0%.	
Ton lots, per pound	3.625¢
Borosil, f.o.b. Philo, Ohio, freight allowed, B 3-4%, Si 40-45%, per lb contained B	$6.25

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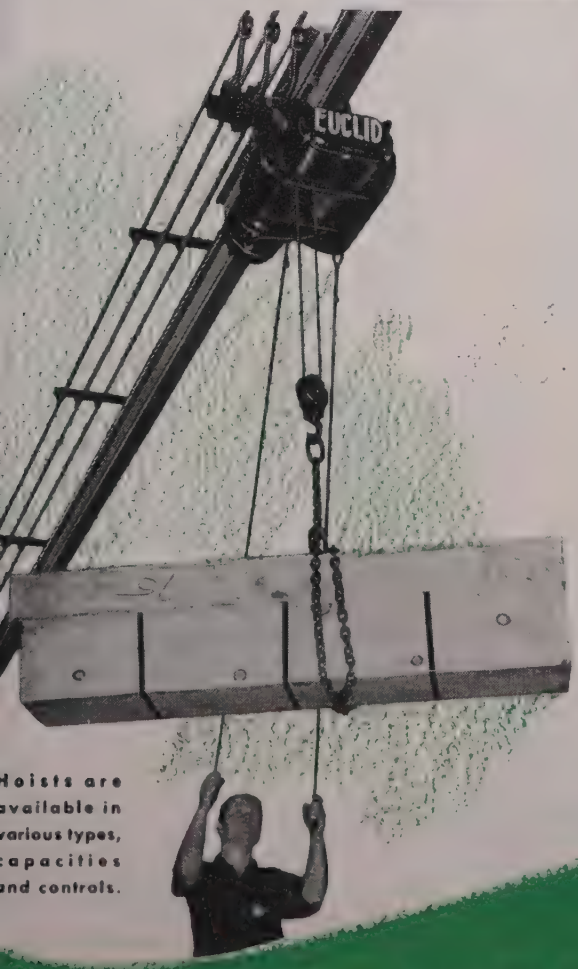

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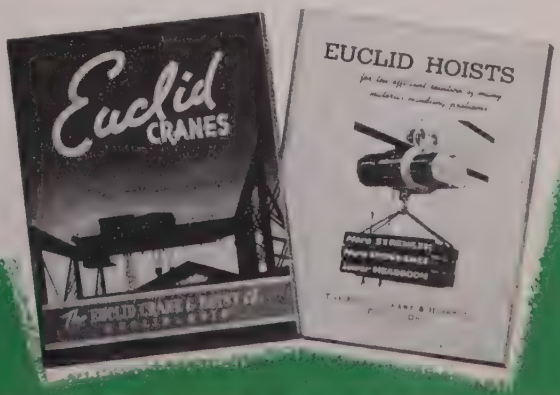

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Button	Grape Tying	Piston Ring	Wire Cloth
	Gutter Broom	Plow Steel	

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REPRESENTATIVES AND WAREHOUSES IN ALL PRINCIPAL CITIES

PRICES AND PRODUCTION

(Continued from page 284)

Cold-Finished Steel Bars at Pittsburgh

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	1.90	1.70	2.10	2.10	2.55	2.90
February	1.90	1.70	2.10	2.10	2.55	2.90
March	1.90	1.70	2.10	2.10	2.83	2.90
April	1.95	1.70	2.10	2.10	2.90	2.90
May	1.95	1.70	2.10	2.10	2.90	2.90
June	1.95	1.70	2.10	2.10	2.90	2.70
July	1.95	1.70	2.10	2.25	2.90	2.70
August	1.95	1.70	2.10	2.25	2.90	2.70
September	1.94	1.95	2.10	2.25	2.90	2.70
October	1.90	1.95	2.10	2.35	2.90	2.70
November	1.90	1.95	2.10	2.35	2.90	2.70
December	1.90	2.10	2.10	2.35	2.90	2.70
Average	1.92	1.80	2.10	2.20	2.84	2.78

	1939		1945	1946	1947	1948
January	2.70		2.65	2.75	3.20	3.55
February	2.70		2.65	2.93	3.20	3.55
March	2.70	1944	2.65	3.10	3.20	3.55
April	2.70	1943	2.65	3.10	3.20	3.55
May	2.68	1942	2.65	3.10	3.20	3.50
June	2.65	1941	2.65	3.10	3.20	3.50
July	2.65	1940 price	2.65	3.10	3.27	3.82
August	2.65	fixed	2.73	3.10	3.55	3.98
September	2.65	at	2.75	3.10	3.55	3.98
October	2.65	2.65	2.75	3.10	3.55	3.98
November	2.65		2.75	3.10	3.55	3.98
December	2.65		2.75	3.10	3.55	3.98
Average	2.67		2.69	3.06	3.35	3.74

Plates at Pittsburgh

(cents per pound)

	1929	1932	1933	1934	1936	1937
January	1.90	1.50	1.60	1.70	1.80	2.05
February	1.90	1.50	1.60	1.70	1.80	2.05
March	1.90	1.52	1.60	1.70	1.80	2.21
April	1.95	1.60	1.55	1.74	1.80	2.25
May	1.95	1.60	1.50	1.85	1.80	2.25
June	1.95	1.60	1.53	1.85	1.80	2.25
July	1.95	1.60	1.60	1.81	1.90	2.25
August	1.95	1.60	1.60	1.80	1.90	2.25
September	1.95	1.60	1.60	1.80	1.90	2.25
October	1.94	1.60	1.70	1.80	1.90	2.25
November	1.90	1.60	1.70	1.80	1.90	2.25
December	1.90	1.60	1.70	1.80	1.90	2.25
Average	1.93	1.57	1.61	1.78	1.85	2.21

	1938		1945	1946	1947	1948
January	2.25		2.10	2.25	2.65	2.95
February	2.25	1944	2.10	2.38	2.65	2.98
March	2.25	1943	2.20	2.50	2.65	2.95
April	2.25	1942	2.20	2.50	2.65	2.95
May	2.25	1941	2.21	2.50	2.65	2.93
June	2.22	1940	2.25	2.50	2.71	2.93
July	2.10	1939 price	2.25	2.50	2.95	3.07
August	2.10	fixed	2.25	2.50	2.95	3.50
September	2.10	at	2.25	2.50	2.95	3.50
October	2.10	2.10	2.25	2.50	2.95	3.50
November	2.10		2.25	2.50	2.95	3.50
December	2.10		2.25	2.50	2.95	3.50
Average	2.17		2.21	2.47	2.80	3.19

Hot-Rolled Sheets at Pittsburgh

(cents per pound)

	1929	1934	1936	1937	1938	1939
January	2.10	1.75	1.85	2.15	2.40	2.15
February	2.10	1.75	1.85	2.15	2.40	2.15
March	2.10	1.75	1.85	2.35	2.40	2.15
April	2.10	1.81	1.85	2.40	2.40	2.15
May	2.13	2.00	1.85	2.40	2.38	2.06
June	2.20	2.00	1.87	2.40	2.27	2.00
July	2.14	1.88	1.95	2.40	2.15	2.00
August	2.10	1.85	1.95	2.40	2.15	2.00
September	2.10	1.85	1.95	2.40	2.15	2.00
October	2.10	1.85	1.95	2.40	2.03	2.00
November	2.10	1.85	1.95	2.40	2.15	2.02
December	2.18	1.85	2.15	2.40	2.15	2.10
Average	2.12	1.85	1.92	2.35	2.25	2.06

	1940		1945	1946	1947	1948
January	2.10		2.10	2.20	2.50	2.80
February	2.10		2.10	2.31	2.50	2.80
March	2.10	1944	2.18	2.425	2.50	2.80
April	2.10	1943	2.20	2.425	2.50	2.80
May	1.98	1942	2.20	2.425	2.50	2.77
June	2.10	1941	2.20	2.425	2.50	2.77
July	2.10	price fixed	2.20	2.425	2.56	2.89
August	2.10	at	2.20	2.425	2.80	3.28
September	2.10	2.10	2.20	2.425	2.80	3.28
October	2.10		2.20	2.425	2.80	3.28
November	2.10		2.20	2.425	2.80	3.28
December	2.10		2.20	2.485	2.80	3.28
Average	2.09		2.18	2.40	2.63	3.00

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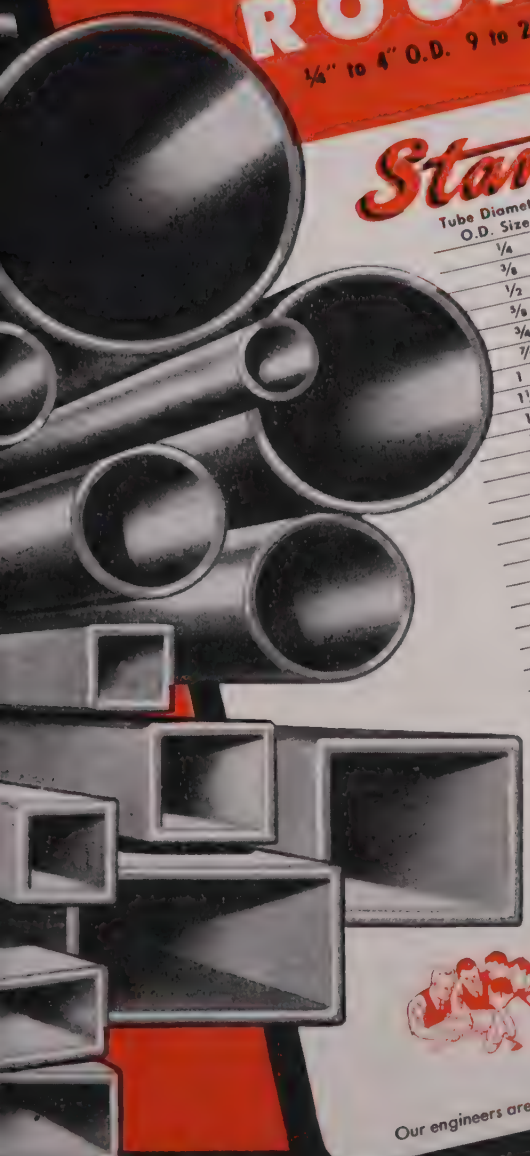
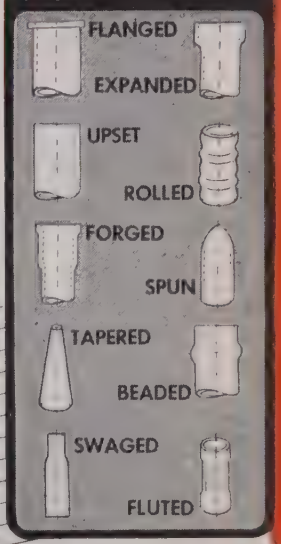


Standard Sizes

Tube Diameter O.D. Size	Maximum Wall BWG Decimal	Maximum Wall BWG Gauge	Minimum Wall BWG Decimal	Minimum Wall BWG Gauge
¼	.049	18	.028	22
⅜	.065	16	.022	24
½	.083	14	.022	24
⅝	.095	13	.022	24
¾	.095	13	.022	24
⅞	.095	13	.022	24
1	.095	13	.022	22
1⅛	.095	13	.028	22
1¼	.095	13	.028	22
1⅜	.095	13	.028	22
1½	.120	11	.028	22
1⅝	.120	11	.028	20
1¾	.120	11	.035	20
1⅞	.148	9	.035	20
2	.148	9	.035	20
2⅛	.148	9	.035	20
2¼	.120	11	.035	20
2⅜	.148	9	.035	20
2½	.120	11	.035	20
2⅝	.148	9	.035	20
2¾	.148	9	.035	20
2⅞	.148	9	.035	20
3	.148	9	.035	20
3⅛	.148	9	.035	20
3¼	.148	9	.035	20
3⅜	.148	9	.035	20
3½	.148	9	.035	20
3⅝	.148	9	.035	20
3¾	.148	9	.049	18
3⅞	.148	9	.049	18
4	.148	9	.049	18
			.049	18
			.049	18
			.049	18
			.049	18
			.049	16
			.065	16
			.065	16
			.065	16

Can be **BENT** *also . . .*



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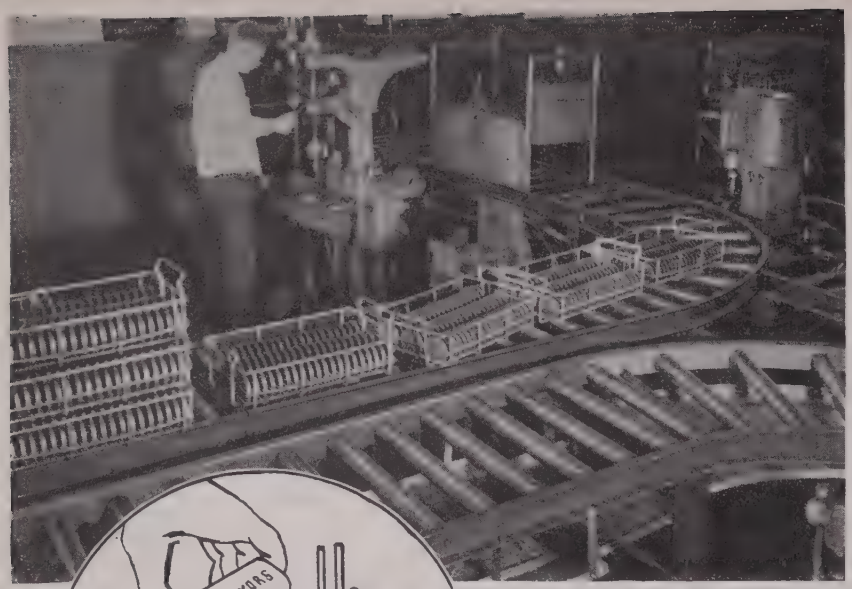


Logan Roller Conveyor handles processing baskets of mechanical refrigerator parts between operations for a nationally known manufacturer.

Conveyors are part of the PROCESS

Conveyors answer the call for station-to-station handling. Economical handling of heavy metals requires dependable continuous flow between processing stations. And whether your task is wrestling bulky coils of steel or routing fabricated products, through manufacturing to shipping . . . Logan Conveyors do it the easy way. Conveyors are a definite part of the process because they eliminate costly time-consuming, pick-up put-down operations, and release workers for tasks that "pay off."

Literature on applying Logan Conveyors to countless handling problems is available. Send for it. There's no obligation.

SINCE Logan 1876

Logan Conveyors

LOGAN CO., INC., 545 CABEL ST., LOUISVILLE 6, KY.

Cold-Rolled Sheets at Pittsburgh

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	4.10	2.35	2.75	2.95	3.25	3.55
February	4.10	2.25	2.75	2.95	3.25	3.50
March	4.10	2.30	2.75	2.95	3.49	3.45
April	4.10	2.30	2.85	2.95	3.55	3.45
May	4.10	2.34	3.15	2.95	3.55	3.43
June	4.10	2.29	3.15	2.95	3.55	3.32
July	4.10	2.40	2.99	3.05	3.55	3.20
August	4.08	2.47	2.95	3.05	3.55	3.20
September	4.00	2.75	2.95	3.05	3.55	3.20
October	4.00	2.75	2.95	3.05	3.55	3.08
November	4.00	2.75	2.95	3.05	3.55	3.20
December	3.98	2.75	2.95	3.25	3.55	3.20
Average	4.06	2.48	2.96	3.02	3.49	3.31

	1939	1940		1946	1947	1948
January	3.20	3.05		3.05	3.20	3.55
February	3.20	3.05		3.16	3.20	3.55
March	3.20	3.05	1945	3.275	3.20	3.55
April	3.20	2.93	1944	3.275	3.20	3.55
May	3.11	3.05	1943	3.275	3.20	3.49
June	3.05	3.05	1942	3.275	3.20	3.49
July	3.05	3.05	1941 price	3.275	3.27	3.62
August	3.05	3.05	fixed	3.275	3.55	4.00
September	3.05	3.05	at	3.275	3.55	4.00
October	3.05	3.05	3.05	3.275	3.55	4.00
November	3.05	3.05		3.275	3.55	4.00
December	3.05	3.05		3.215	3.55	4.00
Average	3.10	3.04		3.242	3.35	3.73

Galvanized Sheets at Pittsburgh

(cents per pound*)

	1929	1932	1933	1934	1936	1937
January	3.60	2.80	2.68	2.85	3.10	3.40
February	3.60	2.75	2.50	2.85	3.10	3.40
March	3.60	2.85	2.60	2.85	3.10	3.72
April	3.60	2.85	2.63	2.95	3.10	3.80
May	3.60	2.85	2.70	3.25	3.10	3.80
June	3.60	2.85	2.70	3.25	3.10	3.80
July	3.60	2.85	2.85	3.13	3.20	3.80
August	3.50	2.81	2.85	3.10	3.20	3.80
September	3.50	2.75	2.85	3.10	3.20	3.80
October	3.50	2.85	2.85	3.10	3.20	3.80
November	3.48	2.85	2.85	3.10	3.20	3.80
December	3.40	2.85	2.85	3.10	3.40	3.80
Average	3.55	2.83	2.74	3.05	3.17	3.73

	1938		1945	1946	1947	1948
January	3.80		3.50	3.70	3.55	3.95
February	3.80	1944	3.50	3.88	3.55	3.95
March	3.80	1943	3.62	4.05	3.55	3.95
April	3.80	1942	3.65	4.05	3.55	3.95
May	3.80	1941	3.66	4.05	3.55	3.91
June	3.68	1940	3.70	4.05	3.55	3.91
July	3.50	1939 price	3.70	4.05	3.63	4.03
August	3.50	fixed	3.70	4.05	3.95	4.40
September	3.50	at	3.70	4.05	3.95	4.40
October	3.45	3.50	3.70	4.05	3.95	4.40
November	3.50		3.70	4.05	3.95	4.40
December	3.50		3.70	*3.65	3.95	4.40
Average	3.64		3.65	3.99	3.72	4.13

* Based on 10 gage since December 1946; 24 gage base up to that time.

Tinplate at Pittsburgh

(per base box, 1.50 lb coating)

	1929	1930	1931	1932	1933	1934
January	$5.35	$5.25	$5.00	$4.75	$4.25	$5.25
February	5.35	5.25	5.00	4.75	4.25	5.25
March	5.35	5.25	5.00	4.75	4.25	5.25
April	5.35	5.25	5.00	4.75	4.25	5.25
May	5.35	5.25	5.00	4.75	4.25	5.25
June	5.35	5.25	5.00	4.75	4.25	5.25
July	5.35	5.25	5.00	4.75	4.25	5.25
August	5.35	5.25	5.00	4.75	4.25	5.25
September	5.35	5.25	5.00	4.75	4.65	5.25
October	5.35	5.00	4.75	4.75	4.65	5.25
November	5.35	5.00	4.75	4.55	4.65	5.25
December	5.35	5.00	4.75	4.25	5.25	5.25
Average	5.35	5.19	4.94	4.69	4.43	5.25

	1938	1937	1938		1947	1948
January	$5.25	$4.85	$5.35		$5.75	$6.80
February	5.25	4.85	5.35	1946	5.75	6.80
March	5.25	4.85	5.35	1945	5.75	6.80
April	5.25	5.35	5.35	1944	5.75	6.80
May	5.25	5.35	5.35	1943	5.75	6.70
June	5.25	5.35	5.35	1942	5.75	6.70
July	5.25	5.35	5.35	1941 1940	5.75	6.72
August	5.25	5.35	5.35	1939	5.75	6.80
September	5.25	5.35	5.35	price	5.75	6.80
October	5.25	5.35	5.35	fixed	5.75	6.80
November	5.25	5.35	5.18	at	5.75	6.80
December	5.25	5.35	5.00	$5.00	5.75	6.80
Average	5.25	5.22	5.31		5.75	6.77

AUTOMATICALLY FROM COIL

EQUIPPED WITH AUTOMATIC ROLL FEED AND CHAIN SPOOL

At Chain Belt Co. continuous steel detachable chain is manufactured complete on each of these Danly presses at the rate of a link per stroke. Operations consist of blanking, piercing, forming, and assembling the chain from steel coil stock which is fed automatically.

PRESSES GIVE LONG TROUBLE-FREE SERVICE

The resulting low manufacturing cost of this high speed operation is not the only economy effected. Extra savings accrue because the presses are designed to stay on the job longer, eliminating expensive down-time. For example, the frames of Danly presses are extra-heavy, welded steel construction, which are fully stress-relieved before machining. This assures continued alignment and a minimum of bed deflection—*no more than .0006" per foot of bolster width.* In turn, accuracy of die alignment is maintained which gives more stampings per die grind and longer die life.

Further, long trouble-free operation is assured by the Danly automatic filtered oiling system. Clean, filtered oil is piped directly to each gear, bearing, and driving member—*including the flywheel bearings.*

NEW SIMPLIFIED CLUTCHING PRINCIPLE

The new Danly air-cooled, air-operated clutch is another exclusive feature that offers unusual advantages in reducing press down-time and maintenance costs. A simplified design reduces starting inertia 85%. Circular friction blocks in a light weight retainer are the only parts to be "picked up" on clutch engagement, reducing wear and assuring long trouble-free clutch service. *Test runs under full load show negligible wear after more than 8-million successive engagements.*

▶ WRITE FOR MORE FACTS

Write today for more facts on the time-saving features of Danly Presses. Find out how Danly Presses can help you cut stamping costs. Ask for a complete presentation and a production estimate.

Danly 75-Ton High Production Press equipped with automatic roll feed and chain spool. Continuous chain is produced at the rate of a link per stroke.

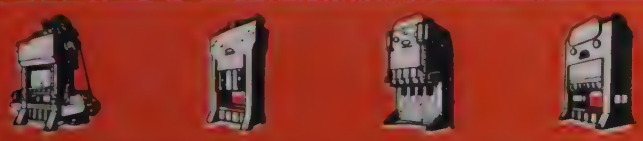
WIDE RANGE OF PRESS SIZES

Danly High Production Presses are built in a wide range of sizes in capacities from 50 to 800 tons.

●

Danly Straight-Side Presses of 1, 2, and 4-point design are built in single, double, and triple-action types in capacities from 100 to 3000 tons.

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS



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FLOOR PLATE

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A Product of ALAN WOOD STEEL COMPANY

Other Products: Permaclad, Stainless Clad Steel • AW Super Grip, Abrasive Floor Plate • Billets • Plates • Sheets (alloy and special grades)

Hot-Rolled Strip at Pittsburgh

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	1.80	1.45	1.75	1.85	2.15	2.40
February	1.80	1.45	1.75	1.85	2.15	2.40
March	1.80	1.45	1.75	1.85	2.35	2.40
April	1.90	1.45	1.81	1.85	2.40	2.40
May	1.90	1.49	2.00	1.85	2.40	2.38
June	1.90	1.55	2.00	1.85	2.40	2.27
July	1.90	1.60	1.88	1.95	2.40	2.15
August	1.90	1.64	1.85	1.95	2.40	2.15
September	1.97	1.68	1.85	1.95	2.40	2.15
October	1.90	1.75	1.85	1.95	2.40	2.03
November	1.90	1.75	1.85	1.95	2.40	2.15
December	1.90	1.75	1.85	2.11	2.40	2.15
Average	1.88	1.58	1.85	1.91	2.35	2.25

	1939	1940		1946	1947	1948
January	2.15	2.10		2.10	2.50	2.80
February	2.15	2.10		*2.23	2.50	2.80
March	2.15	2.10	1945	2.35	2.50	2.80
April	2.15	1.98	1944	2.35	2.50	2.80
May	2.06	2.10	1943	2.35	2.50	2.77
June	2.00	2.10	1942	2.35	2.50	2.77
July	2.00	2.10	1941 price	2.35	2.58	2.89
August	2.00	2.10	fixed	2.35	2.80	3.28
September	2.00	2.10	at	2.35	2.80	3.28
October	2.00	2.10	2.10	2.35	2.80	3.28
November	2.02	2.10		2.35	2.80	3.28
December	2.10	2.10		2.47	2.80	3.28
Average	2.06	2.09		2.33	2.63	3.00

* Over 6 in.: add 0.10c for 6 in. and under from February through November 1946.

Cold-Rolled Strip at Pittsburgh

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	2.85	1.88	2.40	2.60	2.85	3.20
February	2.85	1.80	2.40	2.60	2.85	3.20
March	2.80	1.80	2.40	2.60	3.13	3.20
April	2.75	1.80	2.50	2.60	3.20	3.20
May	2.75	1.88	2.80	2.60	3.20	3.18
June	2.75	2.00	2.80	2.60	3.20	3.07
July	2.75	2.19	2.64	2.60	3.20	2.95
August	2.75	2.25	2.60	2.60	3.20	2.95
September	2.75	2.29	2.60	2.60	3.20	2.95
October	2.75	2.40	2.60	2.60	3.20	2.83
November	2.75	2.40	2.60	2.60	3.20	2.95
December	2.75	2.40	2.60	2.80	3.20	2.95
Average	2.77	2.09	2.58	2.62	3.14	3.05

	1939	1940		1946	1947	1948
January	2.95	2.80		2.80	3.20	3.55
February	2.95	2.80		2.93	3.20	3.55
March	2.95	2.80	1945	3.05	3.20	3.55
April	2.95	2.68	1944	3.05	3.20	3.55
May	2.86	2.80	1943	3.05	3.20	3.53
June	2.80	2.80	1942	3.05	3.20	3.53
July	2.80	2.80	1941 price	3.05	3.27	3.85
August	2.80	2.80	fixed	3.05	3.55	4.00
September	2.80	2.80	at	3.05	3.55	4.00
October	2.80	2.80	2.80	3.05	3.55	4.00
November	2.80	2.80		3.05	3.55	4.00
December	2.80	2.80		3.17	3.55	4.00
Average	2.86	2.79		3.03	3.35	3.76

Bright Wire at Pittsburgh

(cents per pound)

	1929	1931	1932	1933	1934	1937
January	2.50	2.20	2.20	2.16	2.20	2.60
February	2.50	2.20	2.20	2.10	2.20	2.60
March	2.50	2.20	2.20	2.10	2.20	2.84
April	2.50	2.20	2.20	2.10	2.23	2.90
May	2.50	2.20	2.20	2.10	2.30	2.90
June	2.50	2.20	2.20	2.10	2.30	2.90
July	2.50	2.20	2.20	2.10	2.30	2.90
August	2.43	2.20	2.20	2.10	2.30	2.90
September	2.40	2.20	2.20	2.10	2.30	2.90
October	2.40	2.20	2.20	2.10	2.30	2.90
November	2.40	2.20	2.20	2.10	2.30	2.90
December	2.40	2.20	2.20	2.20	2.30	2.90
Average	2.46	2.20	2.20	2.11	2.27	2.84

	1938		1945	1946	1947	1948
January	2.90		2.60	2.75	3.30	3.55
February	2.90		2.60	2.90	3.30	3.55
March	2.90	1941	2.60	3.05	3.30	3.55
April	2.90	1943	2.60	3.05	3.30	3.55
May	2.90	1942	2.63	3.05	3.30	3.60
June	2.84	1941	2.75	3.05	3.30	3.60
July	2.60	1940 1939	2.75	3.05	3.35	3.77
August	2.60	price	2.75	3.05	3.55	4.33
September	2.60	fixed	2.75	3.05	3.55	4.33
October	2.60	at	2.75	3.05	3.55	4.33
November	2.60	2.60	2.75	3.05	3.55	4.33
December	2.60		2.75	3.10	3.55	4.33
Average	2.74		2.69	3.02	3.41	3.90

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Performance results show tool life of Vasco Supreme exceeds that of tools made from ordinary High Speed Steels up to five times or more in the machining of plastics, brass, malleable and cast iron, cast and heat treated steels. These results are being obtained from all types of tools including turning and boring tools, milling cutters, hobs, broaches, drills, taps and reamers.

In addition to better tool life the properties of Vasco Supreme make possible increased speeds of 15 to 100% in many instances.

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—exclusively

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STEEL COMPANY
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.
LATROBE, PENNSYLVANIA

Cast Iron Pipe at New York

(net ton, 6-in. and larger)

	1929	1932	1933	1934	1936	1937
January	$39.60	$30.20	$35.20	$43.00	$45.20	$48.00
February	39.35	29.70	35.30	43.00	45.20	48.00
March	38.60	28.40	35.30	43.00	45.20	51.00
April	37.40	28.20	35.30	43.00	45.20	53.00
May	35.85	28.20	35.30	43.00	45.20	53.00
June	35.10	28.20	38.30	44.00	45.20	53.00
July	33.20	28.73	38.30	45.00	45.90	53.00
August	33.60	31.10	38.30	45.00	45.90	53.00
September	33.60	31.30	38.30	45.00	45.90	53.00
October	34.60	33.30	38.00	45.00	45.90	53.00
November	34.60	33.30	43.00	45.00	45.90	53.00
December	34.60	34.30	43.00	45.00	47.90	53.00
Average	35.84	30.41	37.81	44.08	45.71	52.00

	1938	1939		1946	1947	1948
January	$53.00	$49.00		$57.20	$73.60	$89.18
February	53.00	49.00	1945	57.20	73.75	89.18
March	53.00	49.00	1944	60.20	76.80	89.18
April	53.00	49.00	1943	62.20	79.80	89.18
May	53.00	49.00	1942	62.20	79.80	92.34
June	52.20	49.00	1941	62.20	79.80	95.50
July	49.00	49.00	1940 price	69.60	80.50	95.50
August	49.00	49.00	fixed	69.60	83.30	103.86
September	49.00	49.00	at	69.60	83.30	105.95
October	49.00	52.20	$52.20	69.60	83.96	105.95
November	49.00	52.20		69.60	84.18	105.95
December	49.00	52.20		73.60	84.18	105.95
Average	50.93	49.80		65.23	80.25	97.31

Standard Steel Pipe at Pittsburgh

(per net ton)

Computed from list discounts, for carload lots; price for base size pipe, 1 to 3 in.; 1 in. only since August, 1947; ¾ to 3 in. prior to Apr. 13, 1931

	1929	1931	1932	1933	1934	1936
January	$70.30	$66.50	$64.84	$65.00	$61.75	$68.40
February	70.30	66.50	64.84	65.00	61.75	64.98
March	70.30	66.50	64.84	65.00	61.75	61.80
April	70.30	66.50	64.84	58.00	63.41	61.00
May	70.30	63.59	64.84	58.00	68.40	61.00
June	70.30	64.84	64.84	58.00	68.40	61.00
July	70.30	64.84	64.84	61.75	68.40	61.00
August	70.30	64.84	64.84	61.75	68.40	61.00
September	70.30	64.84	65.00	61.75	68.40	61.00
October	70.30	64.84	65.00	61.75	68.40	61.00
November	70.30	64.84	65.00	61.75	68.40	61.00
December	70.30	64.84	65.00	61.75	68.40	61.00
Average	70.30	65.29	64.89	61.63	66.32	62.01

	1937	1938		1946	1947	1948
January	$61.00	$71.00		$63.00	$79.00	$88.00
February	61.00	71.00	1945	66.00	79.00	90.25
March	69.00	71.00	1944	69.00	79.00	92.50
April	71.00	71.00	1943	69.00	79.00	92.50
May	71.00	71.00	1942	69.00	79.00	91.00
June	71.00	71.00	1941	69.00	79.00	91.00
July	71.00	63.00	1940 1939	69.00	79.00	91.00
August	71.00	63.00	price	69.00	88.00	101.00
September	71.00	63.00	fixed	69.00	88.00	101.00
October	71.00	63.00	at	69.00	88.00	101.00
November	71.00	63.00	$63.00	69.00	88.00	101.00
December	71.00	63.00		71.00	88.00	101.00
Average	69.17	67.00		68.42	82.75	95.10

High Speed Tool Steel 18-4-1

(cents per pound)

	1937		1947	1948
January	80.00	1946*	67.00*	82.00
February	67.00	1945	67.00*	82.00
March	67.00	1944	67.00*	82.00
April	67.00	1943	74.00	82.00
May	67.00	1942	74.00	82.00
June	67.00	1941	74.00	82.00
July	67.00	1940 1939	74.00	82.00
August	67.00	1938	82.00	90.50
September	80.00	price	82.00	90.50
October	80.00	fixed	82.00	90.50
November	80.00	at	82.00	90.50
December	80.00	67.00	82.00	90.50
Average	70.10		75.58	85.50

* An increase of 8.2 pct applies to base price from Feb. 15, 1946, to Mar. 31, 1947.

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The proof of the metal is in the product. Hundreds of manufacturers are building and strengthening their business reputations with products made wholly or in part from Continental steel. Their faith in Continental is vouched for when they put their own valuable trade marks on things they make of Continental sheets or wire. Continental steel products are available in a wide selection of types and sizes. Steel sheets are supplied in a variety of bases and coatings to meet the most exacting needs. Continental manufacturer's wire may be obtained in sizes as small as a thread or as large as ½″ rods, in standard and special shapes and in many different finishes and coatings. Continental Chain Link fence is made of patented KONIK steel to provide low cost property protection through longer life. And nails, staples, and many other steel products round out the product-proved Continental line. To learn more about Continental steel products for industry, farm or home, see your jobber or write Continental at Kokomo.

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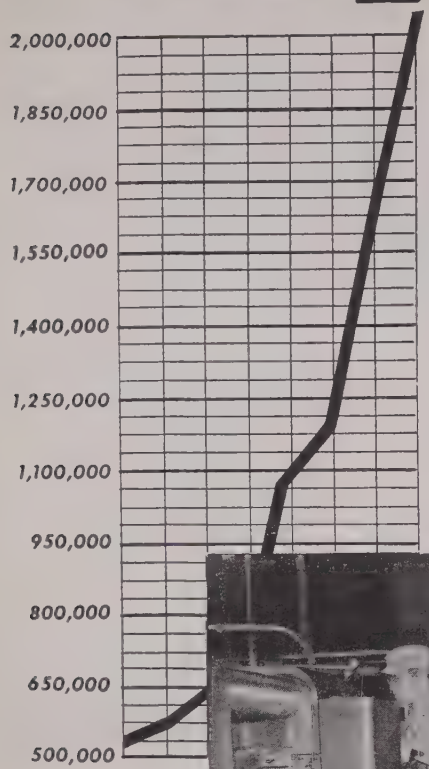
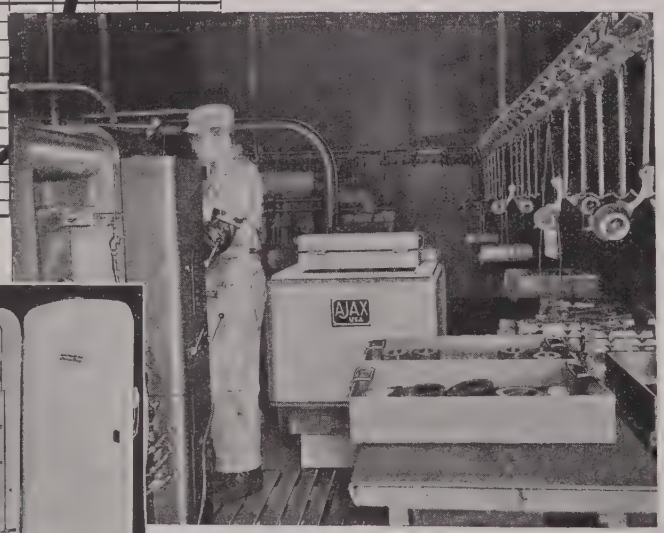
ODUCERS OF *Manufacturer's Wire* in many sizes, KOKOTE, Flame-Sealed, Coppered, Tinned, Annealed, ALSO, Coated and Uncoated Steel Sheets, Nails,

Over 2 Million

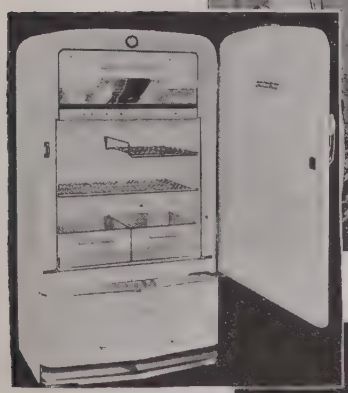


Electric Motors produced monthly in the U.S.A. - - more and more manufacturers are installing

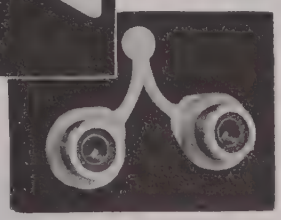
AJAX ELECTRIC FURNACES to improve production.



Part of the modern die casting plant of the Westinghouse Electric Corporation in Springfield, Massachusetts, where thousands of rotors are cast every day for refrigerator units.



The new Westinghouse Refrigerator Model MF-7.



Cast two at a time, these aluminum motor rotors are better because of accurate temperature control and freedom from contamination made possible by Ajax Induction Furnaces.

Included in the millions of motors manufactured nationally, per month, are the hundreds of thousands of fractional horsepower motors that fill the ranks of faithful, alert and silent servants for the American home. Such large output requires ingenious production methods. A great improvement has been achieved by casting the rotors from high purity aluminum. Prominent manufacturers have recognized the advantage of using Ajax-Tama-Wyatt induction furnaces for melting the aluminum prior to casting, because of the accurate temperature control and freedom from contamination with iron or silicon.

Write today for information about this modern method of increasing precision production.

AJAX ENGINEERING CORPORATION, Trenton 7, New Jersey

AJAX TAMA-WYATT **INDUCTION MELTING FURNACE**

Associate Companies: **AJAX METAL COMPANY,** Non-Ferrous Ingot Metals and Alloys for Foundry Use
AJAX ELECTROTHERMIC CORP., Ajax-Northrup High Frequency Induction Furnaces
AJAX ELECTRIC CO., INC., The Ajax-Hultgren Electric Salt Bath Furnace
AJAX ELECTRIC FURNACE CORP., Ajax-Wyatt Induction Furnaces for Melting

Steel Rails at Mill, Openhearth

(per 100 lb.*)

	1929	1932	1933	1934	1936	1937
January	$43.00	$43.00	$40.00	$36.37	$36.37	$39.00
February	43.00	43.00	40.00	36.37	36.37	39.00
March	43.00	43.00	40.00	36.37	36.37	41.80
April	43.00	43.00	40.00	36.37	36.37	42.50
May	43.00	43.00	40.00	36.37	36.37	42.50
June	43.00	43.00	40.00	36.37	36.37	42.50
July	43.00	43.00	40.00	36.37	36.37	42.50
August	43.00	43.00	40.00	36.37	36.37	42.50
September	43.00	43.00	40.00	36.37	36.37	42.50
October	43.00	42.25	39.55	36.37	36.37	42.50
November	43.00	40.00	36.38	36.37	36.37	42.50
December	43.00	40.00	36.38	36.37	39.00	42.50
Average	43.00	42.44	39.26	36.37	36.59	41.86

	1938		1945	1946	1947	1948
January	$42.50		$40.00	$43.00	$2.50	$2.75
February	42.50		40.00	*43.19	2.50	2.75
March	42.50	1944	42.25	43.39	2.50	2.75
April	42.50	1943	43.00	43.39	2.50	2.75
May	42.50	1942	43.00	43.39	2.50	2.72
June	42.50	1941	43.00	43.39	2.50	2.72
July	42.50	1940 1939	43.00	43.39	2.50	2.84
August	42.50	price	43.00	43.39	2.75	3.20
September	41.25	fixed	43.00	43.39	2.75	3.20
October	40.00	at	43.00	43.39	2.75	3.20
November	40.00	$40.00	43.00	43.39	2.75	3.20
December	40.00		43.00	†47.36	2.75	3.20
Average	41.77		42.44	43.67	2.60	2.94

* Prices quoted dollars per gross ton prior to Feb. 15, 1946. Net tons, Feb. 15 to Dec. 13, 1946.

Lake Superior Iron Ores

(per gross ton, at lower Lake Erie ports)

BESSEMER ORES

	Guarantee		Price	
	Iron Natural	Phosphorus Dry	Old Range	Mesabi
1915	55.00	0.045	3.75	3.45
1916	55.00	0.045	4.45	4.20
1917	55.00	0.045	5.95	5.70
1918 to July 1	55.00	0.045	5.95	5.70
1918–July 1 to Sept. 30	55.00	0.045	6.40	6.15
1918–Oct. 1 on	55.00	0.045	6.65	6.40
1919	55.00	0.045	6.45	6.20
1920	55.00	0.045	7.45	7.20
1921	55.00	0.045	6.45	6.20
1922	55.00	0.045	5.95	5.70
1923	55.00	0.045	6.45	6.20
1924	55.00	0.045	4.65	5.40
1925 through 1928	51.50	0.045	4.55	4.40
1929 through 1936	51.50	0.045	4.80	4.65
1937 to Apr. 15, 1940	51.50	0.045	5.25	5.10
1940–Apr. 16 on	51.50	0.045	4.75	4.80
1941 through 1944	51.50	0.045	4.75	4.60
1945 to June 24, 1946	51.50	0.045	4.95	4.70
1946–June24toDec.31	51.50	0.045	5.45	5.20
1947 to Apr. 1, 1948	51.50	0.045	5.95	5.70
1948–April 1 on	51.50	0.045	6.60	6.35

NON-BESSEMER ORES

	Guarantee	Price		
	Iron Natural	Old Range	Mesabi	High Phosphorus
1915	51.50	3.00	2.80	....
1916	51.50	3.70	3.55	....
1917	51.50	5.20	5.05	....
1918 to July 1	51.50	5.20	5.05	....
1918–July 1 to Sept. 30	51.50	5.65	5.50	....
1918–Oct. 1 on	51.50	5.90	5.75	..
1919	51.50	5.70	5.55	$5.35
1920	51.50	6.70	6.55	6.35
1921	51.50	5.70	5.55	5.35
1922	51.50	5.20	5.05	4.85
1923	51.50	5.70	5.55	5.35
1924	51.50	4.90	4.75	4.55
1925 through 1928	51.50	4.40	4.25	4.15
1929 through 1936	51.50	4.65	4.50	4.40
1937 to Apr. 15, 1940	51.50	5.10	4.95	4.85
1940–Apr. 16 on	51.50	4.60	4.45	4.35
1941 through 1944	51.50	4.60	4.45	4.35
1945 to June 24, 1946	51.50	4.80	4.55	4.55
1946–June24toDec.31	51.50	5.30	5.05	5.05
1947 to April 1, 1948	51.50	5.80	5.55	5.55
1948–April 1 on	51.50	6.45	6.20	6.20

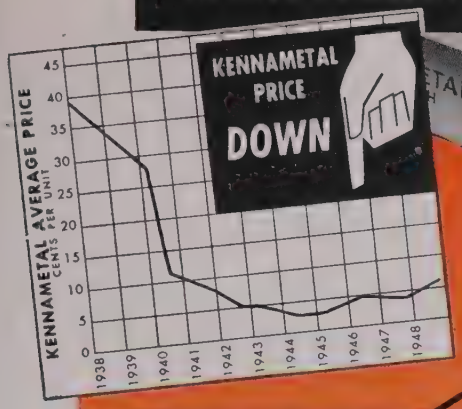
Lake Superior Iron Ore Shipments

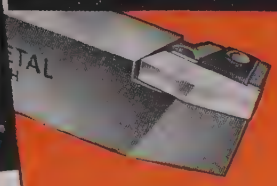
(water movement, gross tons)

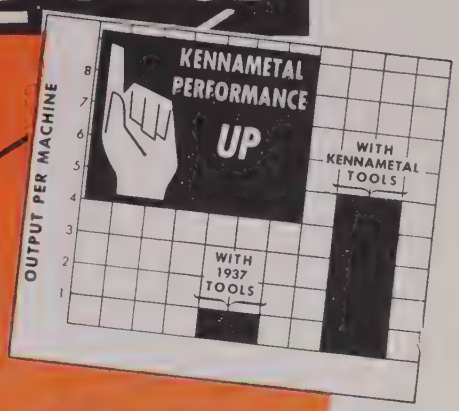
1929	1933	1934	1936
65,204,600	21,623,898	22,249,600	44,822,023
1937	**1938**	**1939**	**1940**
62,598,836	19,263,011	45,072,724	63,712,982
1941	**1942**	**1943**	**1944**
80,116,360	92,076,781	84,404,852	81,170,358
1945	**1946**	**1947**	**1948**
75,714,750	59,356,716	80,570,000	84,737,291*

*Preliminary figure subject to revision.

KENNAMETAL'S PLUS VALUE

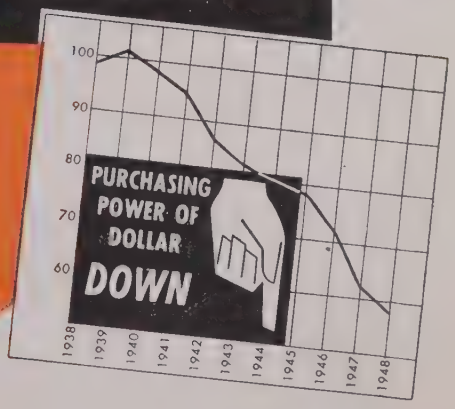






Helps Offset

MONEY'S MINUS VALUE



Living costs for the business family have soared to alarming heights. Prices for every item that enters into the cost of production—equipment, labor, supplies—have been adversely affected by the minus value of United States dollars. "Managed currency" has increased the supply of money *and* inversely decreased its buying power.

An effective means to halt inflation and stabilize our economy is a return to the redeemable Gold Standard*.

In the meantime, technological developments help mitigate the demoralizing effect of high prices. Tools that reduce unit costs add value to the production dollar. An outstanding example is Kennametal.

Carbide tools, as a class, have the inherent capacity to speed up machining operations. When the properties of hardness and strength are sustained at consistent values then performance reliability is high and tool maintenance low.

Kennametal is made by distinctive processes that long experience has proved to be the most effective for producing a close-grained physical structure, free from porosity. Because of this soundness and uniformity, all Kennametal compositions have a plus value.

The dependable, day after day performance of Kennametal tools, together with their unusual durability, help sustain the continuity of machine output and thus make production dollars more valuable.

Kennametal tools and blanks, in eight grades and hundreds of styles and sizes, are described in our Catalog 48. You can make selections to suit your needs with full assurance of outstanding value.

* **Bill H. R. 5031** introduced into the House of Representatives, January 20, 1948, by Congressman Buffet of Nebraska cited as the "Gold Standard Act of 1948."

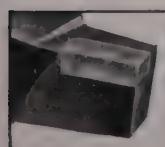
A BILL

"To restore the right of American citizens to freely own gold and gold coins; to return control over the public purse to the people; to restrain further deterioration of our currency; to enable holders of paper money to redeem it in gold coin on demand; to establish and maintain a domestic gold coin standard; and for other purposes."

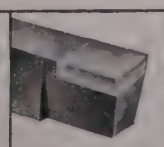
KENNAMETAL

® SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.



BRAZED-ON STYLE BL

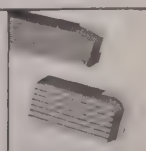


BRAZED-ON STYLE C

BRAZED-ON STYLE FL

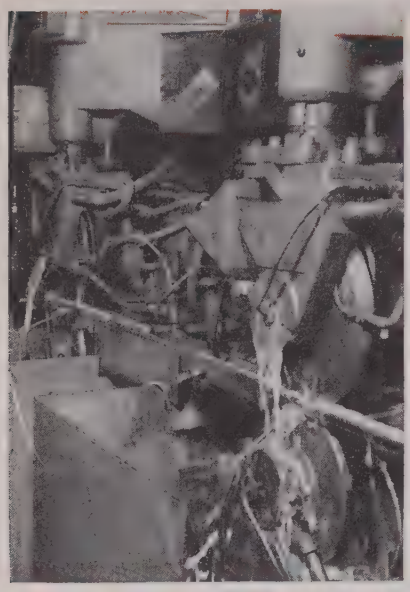
KENNAMATIC STYLE 12SK

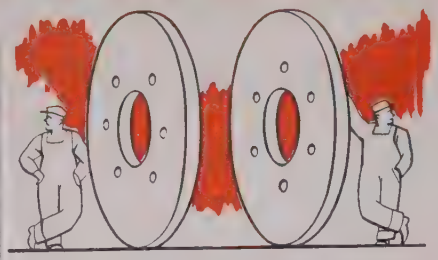
KENDEX STYLE 6TKD



SERRATED MILLING CUTTER BLADES

THEY DON'T SPEAK—





BUT THEY WORK TOGETHER

As brothers, to produce a perfect, enduring seam weld!

WEIGER-WEED TRADE MARK

SEAM WELDING WHEELS

Weiger-Weed Wheels are of uniformly high quality, carefully forged and finished to give (1) strong, clean welds; (2) long life on high production runs; and (3) minimum down time for dressing the welding surfaces. Whatever materials you are welding—carbon steel, stainless steel, tin plate, terne plate and other coated steels, zinc, nickel alloys, weldable bronzes or aluminum—Weiger-Weed has specific alloys, thoroughly proved for quality and fitness, from which wheels can be fabricated. To speed delivery, several sizes of blanks are carried in stock.

Weiger-Weed Wheels are supplied finished to your specifications ready for installation, or in rough form for you to finish to your requirements. Write today for help on your specific seam welding problems.

Ask for your copy of the Weiger-Weed manual to become familiar with Weiger-Weed products and service, to help you turn out stronger, lighter, more easily fabricated products at lower cost.

Weiger-Weed Standard Replaceable Welding Tips

For more and better spot welds at top production speeds, with fewer dressings, use the right Weiger-Weed Tip for your metal and conditions. You can get most sizes and shapes promptly from stock—as well as standard holders that are absolutely leak-proof!

Weiger-Weed produces electrodes and dies for all resistance welding requirements—spot, seam, flash, butt, projection. At your service is top-notch engineering and production skill. Ask the Weiger-Weed engineer for help. Weiger-Weed & Company, Division of Fansteel Metallurgical Corporation, 11644 Cloverdale Avenue, Detroit 4, Michigan.

WEIGER-WEED TRADE MARK

Resistance Welding ELECTRODES
DIES • TIPS • WHEELS • HOLDERS
DIVISION OF FANSTEEL METALLURGICAL CORPORATION

Composite Pig Iron Price

Average of THE IRON AGE quotations on basic pig iron at Valley furnaces and foundry iron at Chicago, Birmingham, Buffalo, Valley and Philadelphia, in gross tons.

	1928	1929	1930	1931	1932	1933
January	$17.63	$18.43	$18.19	$15.90	$14.68	$13.56
February	17.73	18.38	18.02	15.80	14.51	13.56
March	17.73	18.36	17.75	15.71	14.45	13.56
April	17.67	18.52	17.73	15.79	14.35	13.76
May	17.45	18.70	17.60	15.76	14.12	14.48
June	17.23	18.65	17.48	15.62	14.01	15.01
July	17.10	18.48	17.16	15.56	13.76	15.50
August	17.11	18.39	16.90	15.51	13.69	16.09
September	17.54	18.27	16.70	15.44	13.64	16.71
October	17.94	18.33	16.31	15.21	13.63	16.61
November	18.46	18.36	16.21	14.97	13.59	16.61
December	18.51	18.24	15.95	14.86	13.56	16.90
Average	17.68	18.43	17.17	15.51	14.00	15.20

	1934	1936	1937	1938	1939	1940
January	$16.90	$18.84	$20.25	$23.25	$20.61	$22.61
February	16.90	18.84	20.50	23.25	20.61	22.61
March	16.90	18.84	22.85	23.25	20.61	22.61
April	17.07	18.84	23.25	23.25	20.61	22.61
May	17.90	18.84	23.25	23.25	20.61	22.61
June	17.90	18.84	23.25	22.98	20.61	22.61
July	17.90	18.84	23.25	19.61	20.61	22.61
August	17.90	18.73	23.25	19.61	20.61	22.61
September	17.90	18.73	23.25	19.82	21.61	22.61
October	17.90	18.73	23.25	20.57	22.61	22.61
November	17.90	18.98	23.25	20.61	22.61	22.61
December	17.90	19.73	23.25	20.61	22.61	22.95
Average	17.58	18.90	22.74	21.67	21.19	22.64

	1941		1945	1946	1947	1948
January	$23.45		$23.61	$25.37	$30.14	$39.83
February	23.45		24.11	25.37	30.15	40.27
March	23.53		24.61	25.75	32.92	40.32
April	23.61	1944	24.61	26.12	33.15	40.11
May	23.61	1943	24.61	26.45	33.15	40.33
June	23.61	1942	24.61	28.13	33.15	40.51
July	23.61	price fixed	24.61	28.13	34.52	42.25
August	23.61	at	24.61	28.13	36.84	44.34
September	23.61	$23.61	24.61	28.13	36.95	44.96
October	23.61		24.91	28.13	36.95	46.63
November	23.61		25.37	28.13	37.04	46.82
December	23.61		25.37	29.64	37.24	46.82
Average	23.58		24.61	27.29	34.35	42.76

No. 2 Foundry Pig Iron at Granite City, Ill.

(per gross ton, at furnace*)

	1929	1934	1936	1937	1938	1939
January	$20.75	$17.50	$19.50	$21.00	$24.00	$21.00
February	20.75	17.50	19.50	21.25	24.00	21.00
March	20.75	17.50	19.50	23.60	24.00	21.00
April	20.75	17.75	19.50	24.00	24.00	21.00
May	20.75	18.50	19.50	24.00	24.00	21.00
June	20.75	18.50	19.50	24.00	23.00	21.00
July	20.75	18.50	19.50	24.00	20.00	21.00
August	20.69	18.50	19.50	24.00	20.00	21.00
September	20.50	18.50	19.50	24.00	20.25	22.00
October	20.50	18.50	19.50	24.00	21.00	23.00
November	20.50	18.50	19.75	24.00	21.00	23.00
December	20.50	18.50	20.50	24.00	21.00	23.00
Average	20.66	18.19	19.60	23.49	22.20	21.59

	1940		1945	1946	1947	1948
January	$23.00		$24.00	$25.75	$30.50	$39.25
February	23.00		24.50	25.75	30.50	40.00
March	23.00	1944	25.00	26.13	32.00	40.00
April	23.00	1943	25.00	26.50	33.50	40.00
May	23.00	1942	25.00	26.50	33.50	41.43
June	23.00	1941	25.00	28.50	33.50	45.75
July	23.00	price fixed	25.00	28.50	34.60	45.75
August	23.00	at	25.00	28.50	36.63	47.34
September	23.00	$24.00	25.00	28.50	37.00	48.40
October	23.00		25.30	28.50	37.00	48.40
November	23.00		25.75	28.50	37.00	48.40
December	23.50		25.75	29.70	37.00	48.40
Average	23.04		25.02	27.44	34.39	44.42

* Prior to September 1933, St. Louis prices are given.

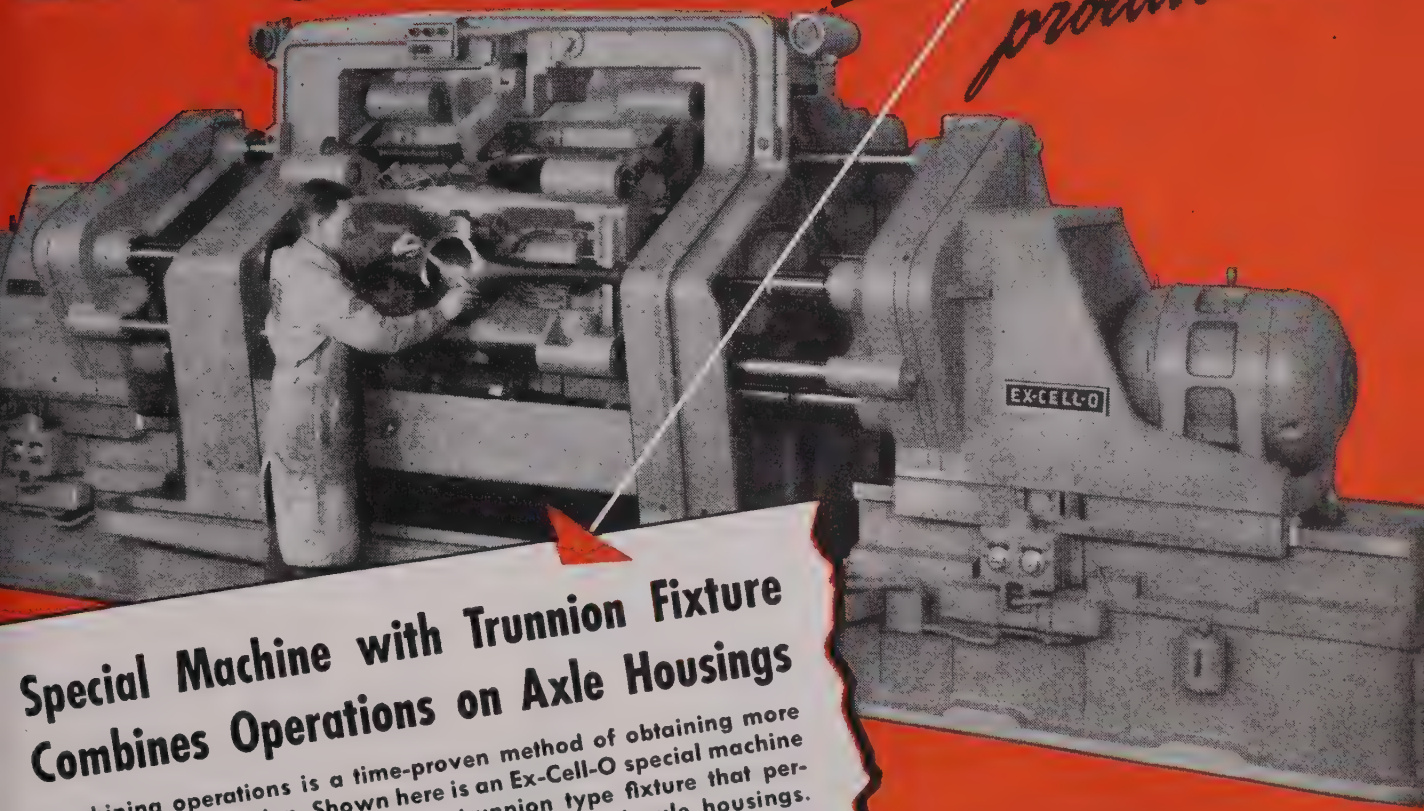
Magnesium, 99.8 Pct Plus

(cents per pound, freight allowed; f. o. b. Freeport, Tex., since Dec. 1, 1947)

1929	56.00	1935	30.00	1941	27.00
1930	48.00	1936	30.00	1942	22.50
1931	34.00	1937	30.00	1943	
1932	29.00	1938	30.00	through	
1933	28.00	1939	27.00	1948	
1934	26.00	1940	27.00	20.50	

EX-CELL-O

Can give you more economical production



Special Machine with Trunnion Fixture Combines Operations on Axle Housings

Combining operations is a time-proven method of obtaining more economical production. Shown here is an Ex-Cell-O special machine with a six-station power indexing trunnion type fixture that performs roughing and finishing operations on steel axle housings. Standard hydraulically-actuated slides at both ends of the machine carry multiple spindle heads and their drive motors. Another slide at the rear supports a precision spindle and a facing head.

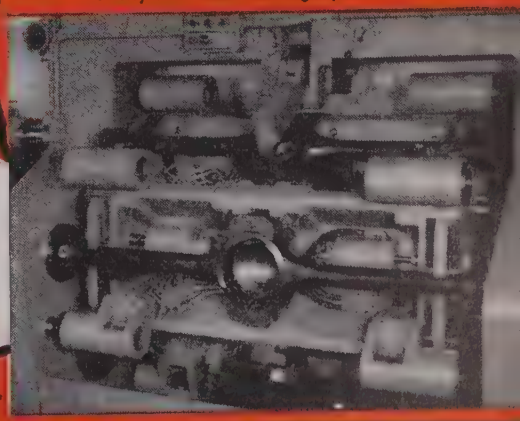
The tool holders in both the multiple spindle heads are rigidly guided by bushings in the fixture end frames. Coolant is manifolded to each station and directed through drilled holes to the point of contact between the tools and the work.

Parts are laid in the loading station and are located and clamped hydraulically. Operations are rough, semi-finish bore and ream bearing diameters at both ends; rough and finish face flanges, chamfer inside and outside edges of flanges and turn O.D. of flanges at both ends; face banjo. All these operations are performed at a net production rate of 55 pieces per hour!

Let Ex-Cell-O help you combine operations for more economical production. A complete staff of experienced machine tool engineers is ready to help you with your production problems. Contact your Ex-Cell-O representative today!

Above: Ex-Cell-O special machine performs many operations on steel rear axle housings.

Below: Close-up view of the Ex-Cell-O six-station trunnion type fixture which easily handles the large parts.



XLO

EX-CELL-O CORPORATION

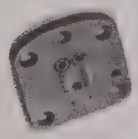
Detroit 32, Michigan

Special Multiple Way Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles •

Productively Generate

SURFACE FLATNESS

MICROFLAT MACHINES



This cast iron valve plate for a refrigeration unit is finished on a double surface Microflat Machine to 8-microinch r.m.s. finish—optically flat and both sides parallel within 0.0001-inch. Production rate is 20 pieces per minute.

FINISH flat surfaces, on any material from soft copper to quartz or nitralloy, regardless of the shape or size of the part, in high production. Opposite sides of one or many parts are finished simultaneously on double surface machines,—productively produced to one light band of flatness and within one microinch r.m.s. surface finish. Recessed surfaces may also be finished on single surface machines.

Let us send more information at your request.

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE, DETROIT 4, MICHIGAN

DISTRICT FIELD OFFICES:

1323 S. Santa Fe, Los Angeles 21, California
616 Empire Bldg., 206 S. Main St., Rockford, Ill.
55 George St., Brantford, Ont., Canada
Micromold Manufacturing Div., Boston Post Road, Guilford, Conn.

PRICES AND PRODUCTION

Malleable Pig Iron at Mahoning or Shenango Valley Furnaces

(per gross ton)

	1929	1934	1936	1937	1938	1939
January	$18.00	$17.50	$19.50	$21.00	$24.00	$21.00
February	18.00	17.50	19.50	21.25	24.00	21.00
March	18.25	17.50	19.50	23.60	24.00	21.00
April	18.50	17.75	19.50	24.00	24.00	21.00
May	19.00	18.50	19.50	24.00	24.00	21.00
June	19.00	18.50	19.50	24.00	23.00	21.00
July	19.00	18.50	19.50	24.00	20.00	21.00
August	19.00	18.50	19.50	24.00	20.00	21.00
September	19.00	18.50	19.50	24.00	20.25	22.00
October	19.00	18.50	19.50	24.00	21.00	23.00
November	19.00	18.50	19.75	24.00	21.00	23.00
December	19.00	18.50	20.50	24.00	21.00	23.00
Average	18.73	18.19	19.60	23.49	22.20	21.59

	1940		1945	1946	1947	1948
January	$23.00		$24.00	$25.75	$30.50	$39.50
February	23.00		24.50	25.75	30.50	39.50
March	23.00	1944	25.00	26.13	33.50	39.50
April	23.00	1943	25.00	26.50	33.50	39.50
May	23.00	1942	25.00	26.50	33.50	39.50
June	23.00	1941	25.00	28.50	33.50	39.50
July	23.00	price fixed	25.00	28.50	34.70	42.50
August	23.00	at	25.00	28.50	36.50	43.50
September	23.00	$24.00	25.00	28.50	36.50	43.50
October	23.00		25.30	28.50	36.50	46.12
November	23.00		25.75	28.50	36.50	46.50
December	23.50		25.75	30.10	36.70	46.50
Average	23.04		25.02	27.48	34.36	42.13

Basic Pig Iron at Mahoning or Shenango Valley Furnaces

(per gross ton)

	1929	1934	1936	1937	1938	1939
January	$17.50	$17.00	$19.00	$20.50	$23.50	$20.50
February	17.50	17.00	19.00	20.75	23.50	20.50
March	17.50	17.00	19.00	23.10	23.50	20.50
April	17.90	17.25	19.00	23.50	23.50	20.50
May	18.38	18.00	19.00	23.50	23.50	20.50
June	18.50	18.00	19.00	23.50	22.70	20.50
July	18.50	18.00	19.00	23.50	19.50	20.50
August	18.50	18.00	19.00	23.50	19.50	20.50
September	18.50	18.00	19.00	23.50	19.75	21.50
October	18.50	18.00	19.00	23.50	20.50	22.50
November	18.50	18.00	19.25	23.50	20.50	22.50
December	18.50	18.00	20.00	23.50	20.50	22.50
Average	18.19	17.69	19.10	22.99	21.70	21.09

	1940		1945	1946	1947	1948
January	$22.50		$23.50	$25.25	$30.00	$38.87
February	22.50		24.00	25.25	30.00	39.00
March	22.50	1944	24.50	25.63	33.00	39.00
April	22.50	1943	24.50	26.00	33.00	39.00
May	22.50	1942	24.50	26.00	33.00	39.00
June	22.50	1941	24.50	28.00	33.00	39.00
July	22.50	price fixed	24.50	28.00	34.20	42.00
August	22.50	at	24.50	28.00	36.00	43.00
September	22.50	$23.50	24.50	28.00	36.00	43.00
October	22.50		24.80	28.00	36.00	45.62
November	22.50		25.25	28.00	36.00	46.00
December	22.90		25.25	29.60	36.20	46.00
Average	22.53		24.52	27.14	34.78	41.62

No. 2 Foundry Pig Iron at Chicago

(per gross ton, at furnace)

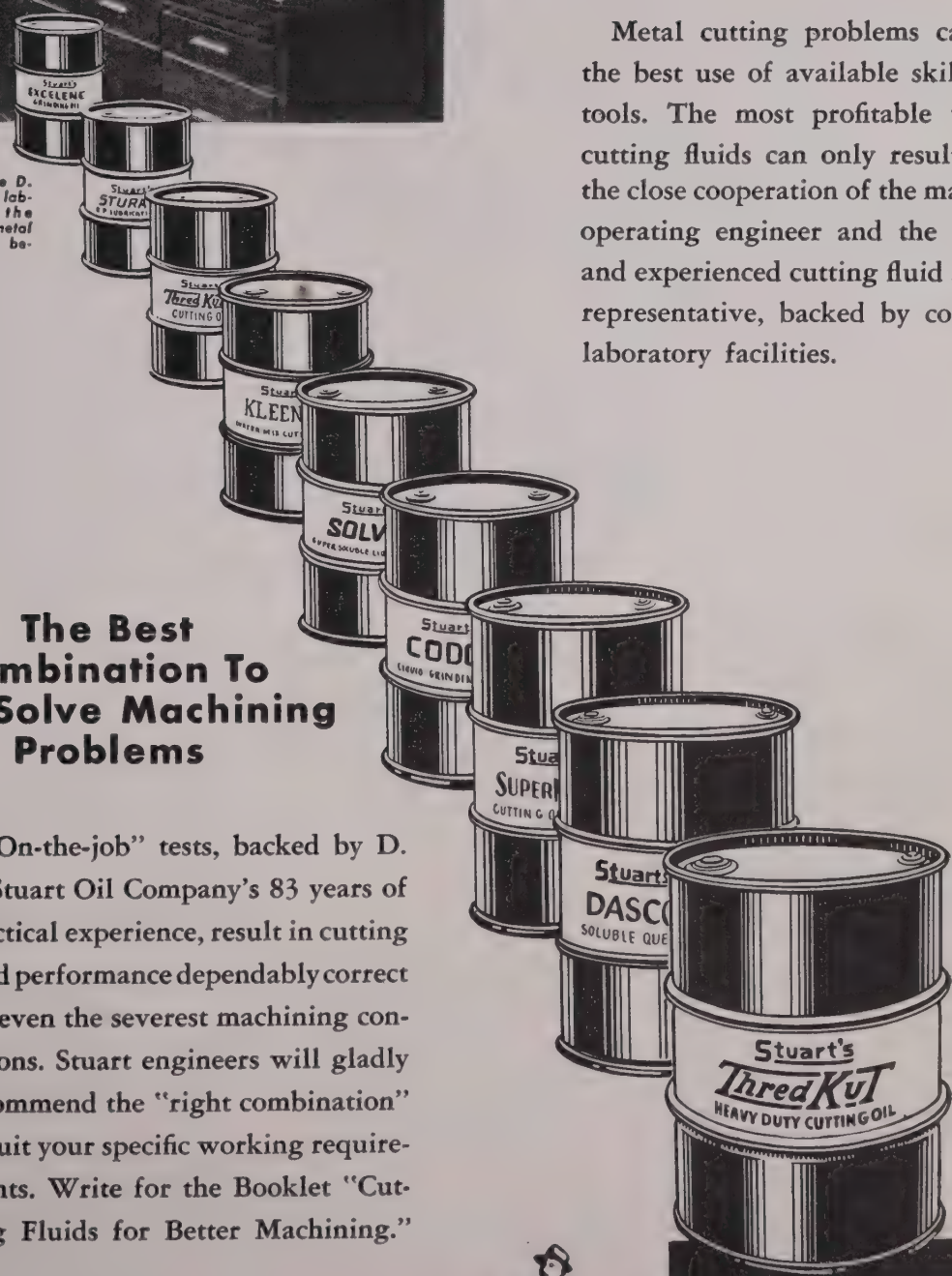
	1929	1934	1936	1937	1938	1939
January	$20.00	$17.50	$19.50	$21.00	$24.00	$21.00
February	20.00	17.50	19.50	21.25	24.00	21.00
March	20.00	17.50	19.50	23.60	24.00	21.00
April	20.00	17.75	19.50	24.00	24.00	21.00
May	20.00	18.50	19.50	24.00	24.00	21.00
June	20.00	18.50	19.50	24.00	23.20	21.00
July	20.00	18.50	19.50	24.00	20.00	21.00
August	20.00	18.50	19.50	24.00	20.00	21.00
September	20.00	18.50	19.50	24.00	20.25	22.00
October	20.00	18.50	19.50	24.00	21.00	23.00
November	20.00	18.50	19.75	24.00	21.00	23.00
December	20.00	18.50	20.50	24.00	21.00	23.00
Average	20.00	18.19	19.60	23.49	22.20	21.59

	1940		1945	1946	1947	1948
January	$23.00		$24.00	$25.75	$30.50	$38.75
February	23.00		24.50	25.75	30.50	39.00
March	23.00		25.00	26.13	33.00	39.00
April	23.00	1944	25.00	26.50	33.00	39.00
May	23.00	1943	25.00	26.50	33.00	39.00
June	23.00	1942	25.00	28.50	33.00	39.00
July	23.00	1941 price	25.00	28.50	34.20	42.00
August	23.00	fixed	25.00	28.50	36.00	43.00
September	23.00	at	25.00	28.50	36.00	43.00
October	23.00	$24.00	25.30	28.50	36.00	46.00
November	23.00		25.75	28.50	36.00	46.00
December	23.40		25.75	30.10	36.40	46.50
Average	23.03		25.02	27.64	34.80	41.69

Partial view of the D. A. Stuart Oil Co. laboratory where the "straight line to metal working efficiency begins."

Skillful Application of Job-Proved Cutting Oils

Metal cutting problems call for the best use of available skills and tools. The most profitable use of cutting fluids can only result from the close cooperation of the machine-operating engineer and the skilled and experienced cutting fluid service representative, backed by complete laboratory facilities.



The Best Combination To Help Solve Machining Problems

"On-the-job" tests, backed by D. A. Stuart Oil Company's 83 years of practical experience, result in cutting fluid performance dependably correct for even the severest machining conditions. Stuart engineers will gladly recommend the "right combination" to suit your specific working requirements. Write for the Booklet "Cutting Fluids for Better Machining."

D.A. Stuart Oil CO.
EST. 1865 LIMITED
2737 SOUTH TROY STREET, CHICAGO 23, ILL.

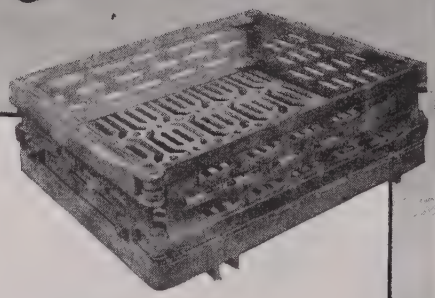
STUART *service goes with every barrel*

The Straight Line To Metal Working Efficiency

DURALOY

Articulated Tray

Corner-Cracking Overcome

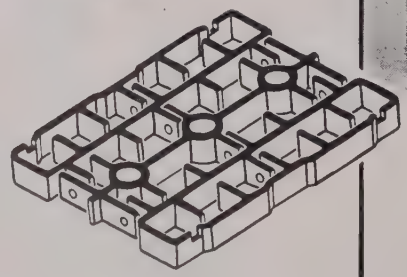


This is something relatively new and certainly considerably better than the conventional one piece tray.

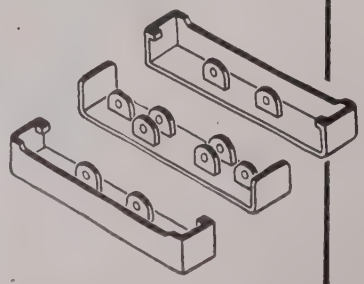
1 . . . rigid corners have been eliminated

2 . . . lighter construction is permissible

3 . . . tray parts are replaceable



If you require heat-treating trays in your plant, why not investigate the Duraloy Articulated Tray*? The principle of design permits wide variations in size and shape. Send us a sketch or description of your present trays and we'll design a Duraloy Tray to take its place and let you know what it will cost.



If interested in high alloy castings generally, send for our Catalog 4729-G.

*Patented

THE DURALOY COMPANY

Office and Plant: Scottdale, Pa. • Pittsburgh • 11 Park Avenue, New York 17, N. Y.

Los Angeles & San Francisco: KILSBY & HARMON

Detroit: [illegible] & ASSOCIATES

METAL GOODS CORP. St. Louis • Houston • [illegible] • Kansas City

PRICES AND PRODUCTION

No. 2 Foundry Pig Iron at Mahoning or Shenango Valley Furnaces

(per gross ton)

	1929	1934	1936	1937	1938	1939
January	$17.50	$17.50	$19.50	$21.00	$24.00	$21.00
February	17.50	17.50	19.50	21.25	24.00	21.00
March	17.75	17.50	19.50	23.60	24.00	21.00
April	18.00	17.75	19.50	24.00	24.00	21.00
May	18.50	18.50	19.50	24.00	24.00	21.00
June	18.50	18.50	19.50	24.00	23.20	21.00
July	18.50	18.50	19.50	24.00	20.00	21.00
August	18.50	18.50	19.50	24.00	20.00	21.00
September	18.50	18.50	19.50	24.00	20.25	22.00
October	18.50	18.50	19.50	24.00	21.00	23.00
November	18.50	18.50	19.75	24.00	21.00	23.00
December	18.50	18.50	20.25	24.00	21.00	23.00
Average	18.23	18.19	19.60	23.49	22.20	21.59

	1940		1945	1946	1947	1948
January	$23.00		$24.00	$25.75	$30.50	$39.37
February	23.00		24.50	25.75	30.50	39.50
March	23.00		25.00	26.13	33.50	39.50
April	23.00	1944	25.00	26.50	33.50	39.50
May	23.00	1943	25.00	26.50	33.50	39.50
June	23.00	1942	25.00	28.50	33.50	39.50
July	23.00	1941 price	25.00	28.50	34.70	42.50
August	23.00	fixed	25.00	28.50	36.50	43.50
September	23.00	at	25.00	28.50	36.50	43.50
October	23.00	$24.00	25.30	28.50	36.50	46.12
November	23.00		25.75	28.50	36.50	46.50
December	23.40		25.75	30.10	36.70	46.50
Average	23.03		25.02	27.64	34.36	42.12

No. 2 Foundry Pig Iron at Buffalo

(per gross ton, at furnace*)

	1929	1934	1936	1937	1938	1939
January	$18.00	$17.50	$19.50	$21.00	$24.00	$21.00
February	18.39	17.50	19.50	21.25	24.00	21.00
March	18.50	17.50	19.50	23.60	24.00	21.00
April	18.50	17.50	19.50	24.00	24.00	21.00
May	18.50	18.50	19.50	24.00	24.00	21.00
June	18.75	18.50	19.50	24.00	23.20	21.00
July	19.50	18.50	19.50	24.00	20.00	21.00
August	19.50	18.50	19.50	24.00	20.00	21.00
September	19.50	18.50	19.50	24.00	20.13	22.00
October	19.50	18.50	19.50	24.00	20.88	23.00
November	19.50	18.50	19.75	24.00	21.00	23.00
December	19.50	18.50	20.50	24.00	21.00	23.00
Average	18.97	18.17	19.60	23.40	22.18	21.59

	1940		1945	1946	1947	1948
January	$23.00		$24.00	$25.75	$30.50	$40.37
February	23.00		24.50	25.75	30.50	42.12
March	23.00		25.00	26.13	32.38	42.45
April	23.00	1944	25.00	26.50	33.00	41.19
May	23.00	1943	25.00	26.50	33.00	41.37
June	23.00	1942	25.00	28.50	33.00	41.44
July	23.00	1941 price	25.00	28.50	34.20	42.08
August	23.00	fixed	25.00	28.50	37.37	44.90
September	23.00	at	25.00	28.50	37.18	45.87
October	23.00	$24.00	25.30	28.50	37.00	47.12
November	23.00		25.75	28.50	37.75	47.50
December	23.40		25.75	30.10	38.00	47.50
Average	23.03		25.02	27.64	34.49	43.65

*Average price, since Aug. 13, 1947, includes Republic Steel Co.'s sales based on THE IRON AGE weekly scrap quotations.

Structural Shapes at Pittsburgh

(cents per pound)

	1929	1931	1932	1933	1934	1936
January	1.90	1.64	1.50	1.60	1.70	1.80
February	1.90	1.65	1.50	1.60	1.70	1.80
March	1.90	1.65	1.52	1.60	1.70	1.80
April	1.95	1.65	1.60	1.60	1.74	1.80
May	1.95	1.65	1.60	1.60	1.85	1.80
June	1.95	1.65	1.60	1.60	1.85	1.80
July	1.95	1.63	1.60	1.60	1.81	1.90
August	1.95	1.60	1.60	1.60	1.80	1.90
September	1.95	1.60	1.60	1.60	1.80	1.90
October	1.90	1.60	1.60	1.70	1.80	1.90
November	1.90	1.60	1.60	1.70	1.80	1.90
December	1.90	1.50	1.60	1.70	1.80	1.90
Average	1.92	1.62	1.57	1.68	1.78	1.85

	1937	1938		1946	1947	1948
January	2.05	2.25		2.10	2.50	2.80
February	2.05	2.25	1945	2.23	2.50	2.80
March	2.21	2.25	1944	2.35	2.50	2.80
April	2.25	2.25	1943	2.35	2.50	2.80
May	2.25	2.25	1942	2.35	2.50	2.76
June	2.25	2.22	1941	2.35	2.50	2.76
July	2.25	2.10	1940 1939	2.35	2.56	2.88
August	2.25	2.10	price	2.35	2.80	3.28
September	2.25	2.10	fixed	2.35	2.80	3.28
October	2.25	2.10	at	2.35	2.80	3.28
November	2.25	2.10	2.10	2.35	2.80	3.28
December	2.25	2.10		2.35	2.80	3.28
Average	2.21	2.17		2.32	2.63	3.00

This special "Inductomatic" machine at the Salisbury Axle Plant is powered by two 125 KW, 10,000 cycle TOCCO Induction Heating Units.

By TOCCO* Induction Hardening of Axle Shafts

WHAT progressive engineers at the Salisbury Axle Division of Dana Corporation have done with Induction Heating for hardening automotive axle shafts suggests comparable savings for your products. Note this report:

SAVINGS of $375.00 per day caused by increased output and switch from SAE 4140 to SAE 1033 steel made possible by induction hardening.

LESS MACHINING time because shaft of SAE 1033 steel is completely machined prior to hardening. Tool cost cut in half—turning time reduced from 2 minutes to 30 seconds.

PRODUCTION DOUBLED. Formerly 50 axle shafts per hour with conventional combustion type heating—now 120 per hour with TOCCO.

PRODUCT IMPROVED. Torsional fatigue has increased 200%. The shaft is no longer a compromise between durability and machinability. It is hardened to 55 RC and drawn back to 43-47 RC. Degree of hardness and depth is accurately controlled.

TOCCO Engineers will gladly survey *your* operations for similar cost-cutting results in hardening, heat-treating or brazing—without obligation.

THE OHIO CRANKSHAFT COMPANY

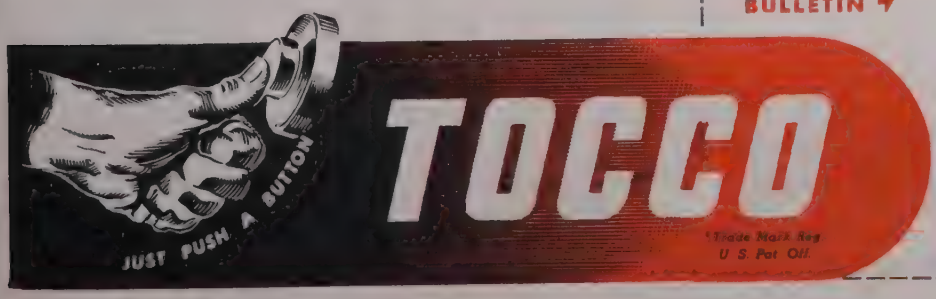
Mail Coupon Today

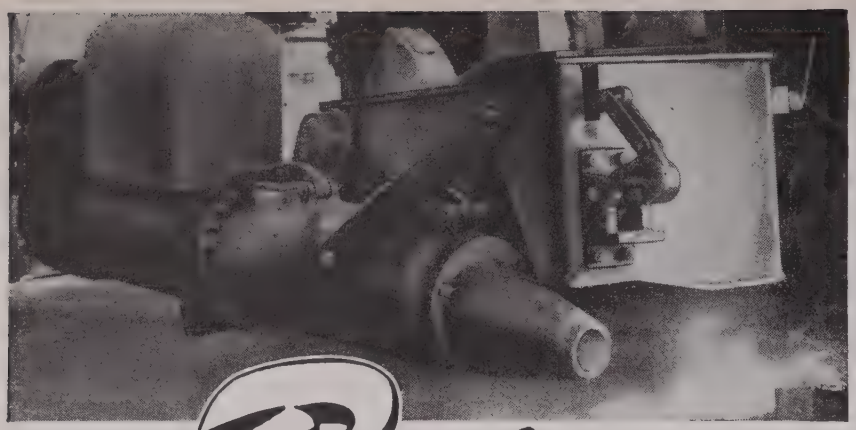
FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. A-1, Cleveland 1, Ohio

Please send copy of new bulletin. *"Principles of TOCCO Induction Hardening and Heat Treating".*

Name _____
Position _____
Company _____
Address _____
City _____ Zone ____ State _____



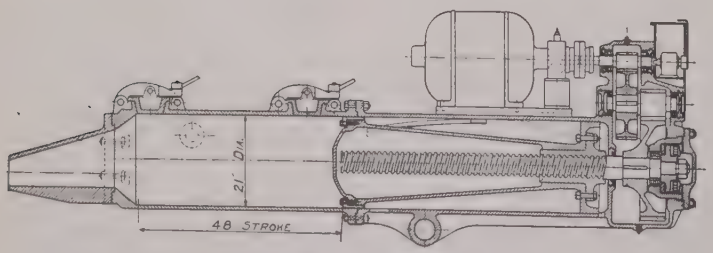


Bailey

CLAY GUN

Powerful electrically-driven Piston

The Bailey Lever Action forces the nose of the gun to accurately hit the tapping hole. In the Bailey Clay Gun, the powerful, positive motor-driven screw provides the pressure necessary on the piston to maintain long tapping holes.



High nozzle pressure assures safety to furnace and workmen

WILLIAM M. Bailey COMPANY
ENGINEERS
LEADERSHIP THROUGH QUALITY
PITTSBURGH PENNSYLVANIA

PRICES AND PRODUCTION

Merchant Bars at Pittsburgh

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	1.90	1.60	1.75	1.85	2.20	2.45
February	1.90	1.60	1.75	1.85	2.20	2.45
March	1.90	1.60	1.75	1.85	2.40	2.45
April	1.95	1.60	1.79	1.85	2.45	2.45
May	1.95	1.60	1.90	1.85	2.45	2.45
June	1.95	1.60	1.90	1.85	2.45	2.41
July	1.95	1.60	1.82	1.95	2.45	2.25
August	1.95	1.60	1.80	1.95	2.45	2.25
September	1.94	1.60	1.80	1.95	2.45	2.25
October	1.90	1.75	1.80	2.07	2.45	2.25
November	1.90	1.75	1.80	2.05	2.45	2.25
December	1.90	1.75	1.80	2.03	2.45	2.25
Average	1.92	1.64	1.81	1.95	2.40	2.35

	1939		1945	1946	1947	1948
January	2.25		2.15	2.25	2.60	2.90
February	2.25		2.15	2.38	2.60	2.90
March	2.25	1944	2.15	2.50	2.60	2.90
April	2.25	1943	2.15	2.50	2.60	2.90
May	2.19	1942	2.17	2.50	2.60	2.87
June	2.15	1941	2.25	2.50	2.60	2.87
July	2.15	1940 price	2.25	2.50	2.66	3.00
August	2.15	fixed	2.25	2.50	2.90	3.45
September	2.15	at	2.25	2.50	2.90	3.45
October	2.15	2.15	2.25	2.50	2.90	3.45
November	2.15		2.25	2.50	2.90	3.45
December	2.15		2.25	2.56	2.90	3.45
Average	2.19		2.21	2.47	2.73	3.13

Ferromanganese, 80 Pct

(carloads, per gross ton, average of Eastern Producers*)

	1929	1934	1936	1937	1938	1939
January	$105.00	$85.00	$75.00	$80.00	$102.50	$85.00
February	105.00	85.00	75.00	80.00	102.50	80.00
March	105.00	85.00	75.00	89.00	102.50	80.00
April	105.00	85.00	75.00	95.00	102.50	80.00
May	105.00	85.00	75.00	100.62	102.50	80.00
June	105.00	85.00	75.00	102.50	102.50	80.00
July	105.00	85.00	75.00	102.50	92.50	80.00
August	105.00	85.00	75.00	102.50	92.50	80.00
September	105.00	85.00	75.00	102.50	92.50	95.00
October	105.00	85.00	75.00	102.50	92.50	100.00
November	105.00	85.00	80.00	102.50	92.50	100.00
December	105.00	85.00	80.00	102.50	92.50	100.00
Average	105.00	85.00	75.83	96.84	97.50	86.67

	1940	1941	1942		1947	1948
January	$100.00	$120.00	$120.00		$135.00	$145.00
February	100.00	120.00	120.00		135.00	145.00
March	100.00	120.00	120.00	1946	135.00	145.00
April	100.00	120.00	120.00	1945	135.00	145.00
May	100.00	120.00	135.00	1944	135.00	145.00
June	110.00	120.00	135.00	1943	135.00	145.00
July	120.00	120.00	135.00	price fixed	135.00	145.00
August	120.00	120.00	135.00	at	135.00	145.00
September	120.00	120.00	135.00	$135.00	135.00	145.00
October	120.00	120.00	135.00		145.00	161.71
November	120.00	120.00	135.00		145.00	161.71
December	120.00	120.00	135.00		145.00	161.71
Average	110.84	120.00	130.00		137.50	149.18

* Seaboard price prior to October 7, 1948.

Spiegeleisen, 19 to 21 Pct

(carloads, per gross ton, Palmerton, Pa.)

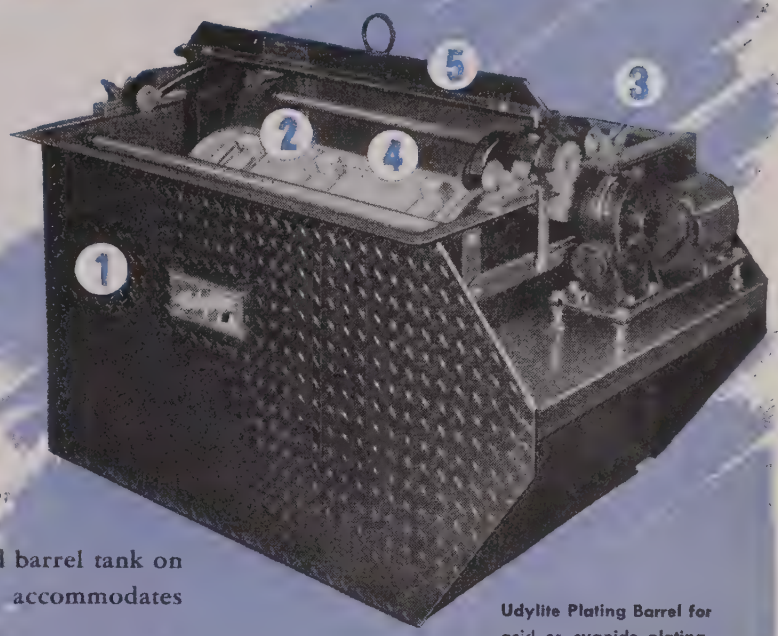
	1929	1933	1934	1936	1937	1938
January	$31.00	$24.00	$27.00	$26.00	$26.00	$33.00
February	31.00	24.00	27.00	26.00	26.00	33.00
March	31.00	24.00	26.50	26.00	28.40	33.00
April	31.00	24.00	26.00	26.00	30.00	33.00
May	31.00	24.00	24.00	26.00	32.25	33.00
June	31.00	24.00	26.00	26.00	33.00	33.00
July	31.00	27.00	26.00	26.00	33.00	28.00
August	31.00	27.00	26.00	26.00	33.00	28.00
September	31.00	27.00	26.00	26.00	33.00	28.00
October	31.00	27.00	26.00	26.00	33.00	28.00
November	31.00	27.00	26.00	26.00	33.00	28.00
December	31.00	27.00	26.00	26.00	33.00	28.00
Average	31.00	25.50	26.21	26.00	31.14	30.50

	1939	1940		1946	1947	1948
January	$28.00	$32.00		$36.00	$40.00	$47.00
February	28.00	32.00		36.00	40.00	47.00
March	28.00	32.00	1945	36.00	42.00	48.00
April	28.00	32.00	1944	36.00	44.00	52.00
May	28.00	32.00	1943	36.00	44.00	52.00
June	28.00	34.40	1942	36.00	44.00	52.00
July	28.00	36.00	1941 price	36.00	44.00	52.00
August	28.00	36.00	fixed	36.00	46.25	53.00
September	31.00	36.00	at	36.00	47.00	60.75
October	32.00	36.00	$36.00	36.00	47.00	62.00
November	32.00	36.00		38.00	47.00	62.00
December	32.00	36.00		40.00	47.00	62.00
Average	29.25	34.20		36.50	44.35	54.15

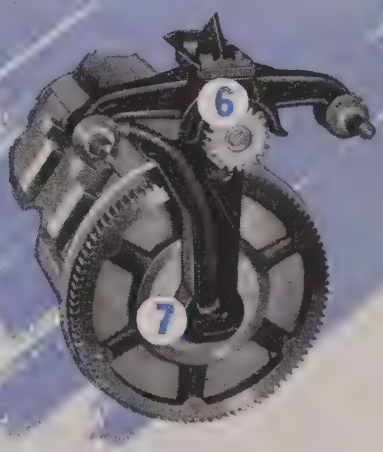
Compare this Barrel with any other built!

Check these features that spell...

★ LOWER MAINTENANCE COST
★ CONTINUOUS PRODUCTION
★ FINEST FINISHES
★ REDUCED PLATING COSTS!



Udylite Plating Barrel for acid or cyanide plating.



1. Big, double-welded tank (largest standard barrel tank on the market). Leak-proof construction. Easily accommodates heating or cooling coils.

2. "Deep-Dip" Plating Cylinder. Hangs deeply in the tank to submerge completely inside of barrel, for greater current capacity and *faster* plating.

3. Heavy contact saddles, of cast brass, machined for perfect contact with cathode horns. Self-locking device prevents barrel rocking.

4. Rigid rails, reinforced by ¾" steel stay bolts running length of cylinder.

5. Large, steel bridge member holds cylinder in rigid alignment.

6. Steel pinions are hardened and ground for longer life.

7. Cylinder rotates on large, non-treeing bearings.

NAME WHAT YOU NEED . . . UDYLITE HAS IT!

• In addition to the sturdiest, most efficient plating barrels ever built (for both acid and cyanide), Udylite offers a complete line of Fully Automatic and Semi-Automatic Plating Machines, tested laboratory supplies, and *complete service,* from no-cost testing of your solutions to design of entire plating plants. Call in a Udylite Technical Man on *any* plating problem!

Udylite Corporation, Detroit 11, Michigan

THE Udylite CORPORATION

"PIONEER OF A BETTER WAY IN PLATING"

Crimpy
The Buffalo Wire Cloth Man
Gets Tinned!

I PUT ON A COAT OF TIN

. . . right over my steel wire before I'm woven, to take on separating, sorting and cleaning jobs with flour, chemicals, powders, seeds and foods.

BRING ON THE FOOD! I'M NON-CONTAMINATING

My coating is pure tin . . . and smooth as silk. Oh, that's not all! I resist humidity . . .

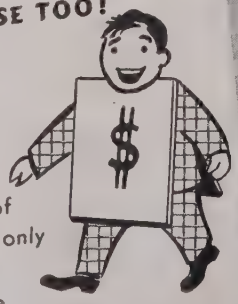
BUT MY MIND ISN'T ALWAYS ON FOOD!

I'm fast . . . can take quite a bit of abrasion, as you can see!

PEOPLE FIND ME EASY TO WORK WITH!

Want to form me? Go ahead! Easy? You bet- unroll me and I'm always flat and straight- don't draw like other cloths.

I'M ATTRACTIVE PRICE-WISE TOO!



I've the economy of steel with only the small difference for my tin coating. But its that coating which improves separation by filling my pores!

"BUFFALO" TINNED WIRE CLOTH

Woven in a large range of square meshes; available in rolls or cut pieces; made into reel covers; furnished with hook strips or webbing.

Buffalo WIRE WORKS CO., INC.

Manufacturers of All Kinds of Wire Cloth Since 1857

456 TERRACE BUFFALO 2, N. Y.

PRICES AND PRODUCTION

Scrap Composite Price

Average of THE IRON AGE quotations on No. 1 heavy melting scrap at Pittsburgh, Chicago and Philadelphia, per gross ton.

	1929	1937	1938	1939	1940	1941
January	$17.02	$18.33	$14.00	$14.94	$17.58	$20.88
February	16.96	19.27	13.86	15.01	16.88	20.08
March	16.71	21.25	13.46	15.20	16.56	20.29
April	17.18	21.02	12.40	14.77	16.14	19.22
May	16.54	18.54	11.54	14.17	17.60	19.17
June	16.39	17.28	11.32	14.71	19.31	19.17
July	16.60	18.79	13.29	14.92	18.47	19.17
August	16.86	20.43	14.51	15.43	18.72	19.17
September	16.60	18.73	14.34	18.32	19.91	19.17
October	15.78	15.89	14.21	21.48	20.63	19.17
November	14.83	13.34	14.74	19.66	20.83	19.17
December	14.15	13.46	14.88	18.05	21.42	19.17
Average	16.30	18.03	13.54	16.39	18.67	19.49

		1944	1945	1946	1947	1948
January		$19.17	$19.17	$19.17	$31.00	$40.81
February		19.17	19.17	19.17	33.31	40.35
March		19.17	19.17	19.17	38.65	40.00
April	1943	19.17	19.17	19.17	33.85	40.31
May	1942	19.17	19.05	19.17	29.81	40.60
June	price fixed	19.17	19.00	19.17	32.79	40.66
July	at	19.17	19.17	19.17	37.95	41.60
August	$19.17	19.10	19.17	19.17	39.46	43.16
September		17.87	19.17	19.17	37.77	43.16
October		15.87	19.17	19.17	40.50	43.16
November		16.54	19.17	23.34	41.21	43.03
December		19.04	19.17	28.23	40.00	43.03
Average		18.55	19.15	20.27	36.36	41.66

No. 1 Heavy Melting Scrap at Pittsburgh

(per gross ton)

	1929	1937	1938	1939	1940	1941
January	$19.31	$19.50	$14.25	$15.72	$18.35	$22.13
February	18.63	19.81	14.13	15.72	17.50	21.00
March	18.44	23.15	13.67	15.97	16.88	21.00
April	18.60	22.25	12.44	15.31	16.55	20.20
May	17.88	19.38	11.50	14.48	18.37	20.00
June	18.25	18.45	11.30	15.12	20.06	20.00
July	18.55	19.75	14.25	15.56	19.10	20.00
August	19.00	21.85	15.45	16.15	18.56	20.00
September	18.31	19.62	15.25	19.88	20.00	20.00
October	17.30	16.62	15.00	23.05	21.45	20.00
November	16.39	13.75	15.28	20.58	21.69	20.00
December	15.45	13.75	15.75	18.58	22.28	20.00
Average	18.01	18.86	14.02	17.17	19.23	20.36

		1944	1945	1946	1947	1948
January		$20.00	$20.00	$20.00	$32.25	$40.37
February		20.00	20.00	20.00	34.94	40.43
March		20.00	20.00	20.00	39.85	40.25
April	1943	20.00	20.00	20.00	35.40	40.25
May	1942	20.00	20.00	20.00	30.38	40.25
June	price fixed	20.00	20.00	20.00	33.88	40.25
July	at	20.00	20.00	20.00	38.45	40.87
August	$20.00	19.95	20.00	20.00	40.00	42.75
September		18.25	20.00	20.00	37.75	42.75
October		16.10	20.00	20.00	40.75	42.75
November		17.13	20.00	23.94	41.88	42.75
December		19.94	20.00	29.00	40.00	42.75
Average		19.28	20.00	21.08	37.13	41.36

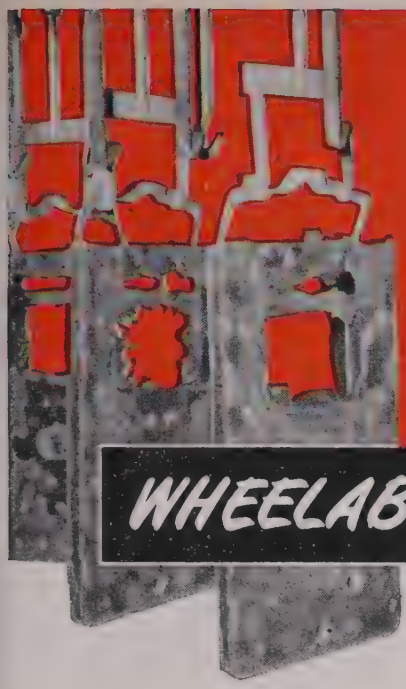
No. 1 Heavy Melting Scrap at Chicago

(per gross ton)

	1929	1937	1938	1939	1940	1941
January	$15.39	$17.81	$13.00	$13.87	$16.38	$20.00
February	15.88	19.25	12.69	13.94	15.75	19.25
March	15.66	20.60	12.15	14.25	15.69	19.88
April	15.95	20.56	11.37	13.37	15.33	18.95
May	15.39	17.12	11.00	12.75	17.00	18.75
June	14.94	15.70	10.45	13.45	18.19	18.75
July	14.75	17.62	12.00	13.50	17.35	18.75
August	15.06	19.70	13.75	13.87	18.03	18.75
September	15.13	17.56	13.50	16.22	19.22	18.75
October	14.30	14.69	12.88	19.16	19.75	18.75
November	13.15	12.50	14.20	17.85	20.06	18.75
December	12.50	12.38	13.75	16.67	20.60	18.75
Average	14.84	17.12	12.56	14.91	17.73	19.01

		1944	1945	1946	1947	1948
January		$18.75	$18.75	$18.75	$29.75	$39.56
February		18.75	18.75	18.75	31.63	39.12
March		18.75	18.75	18.75	36.69	38.95
April	1943	18.75	18.75	18.75	33.05	39.18
May	1942	18.75	18.75	18.75	29.38	39.25
June	price fixed	18.75	18.75	18.75	30.88	39.25
July	at	18.75	18.75	18.75	36.97	40.81
August	$18.75	18.75	18.75	18.75	39.88	41.75
September		18.69	18.75	18.75	38.75	41.75
October		16.90	18.75	18.75	40.50	41.75
November		17.00	18.75	23.13	39.13	41.75
December		18.69	18.75	27.25	38.90	41.75
Average		18.27	18.75	19.87	35.45	40.40

from scaly crust to silvery casting in 15 seconds



WHEELABRATOR® cleans radiator and boiler sections in record time

Time is money. And whenever the Airless "WHEELABRATOR" is put to work it cuts hours of blast cleaning time every working day. The torrent of abrasive thrown by the Airless Wheelabrator, under perfect control, strips every semblance of scale and sand from the most intricate castings, leaving them brilliantly clean.

Utilizing a centrifugal wheel, the Airless Wheelabrator throws more abrasive and throws it harder per horsepower expended than any other blasting device ever conceived. The Wheelabrator principle has been incorporated in a variety of machine sizes and types to provide the right equipment for every blast cleaning job.

TYPICAL PERFORMANCE on Radiators and Boiler Sections

With the installation of a No. 2 Wheelabrator Multi-Table at the Babcock and Wilcox Co., Barberton, Ohio, more boiler wall blocks were cleaned in the first thirty minutes of operation than one man could clean in a full day with a sand blast unit.

• • •

A Wheelabrator Plain Table and a 36" x 42" Wheelabrator Tumblast installed at Foster Wheeler Limited, St. Catharines, Ontario are cleaning approximately 12 tons of gray iron boiler and stoker castings daily. The Wheelabrator is cleaning work in 3 minutes . . . and doing a more perfect job than they could achieve in 45 minutes with their previous barrel method.

SOLVE YOUR CLEANING PROBLEMS IN OUR TESTING LABORATORY

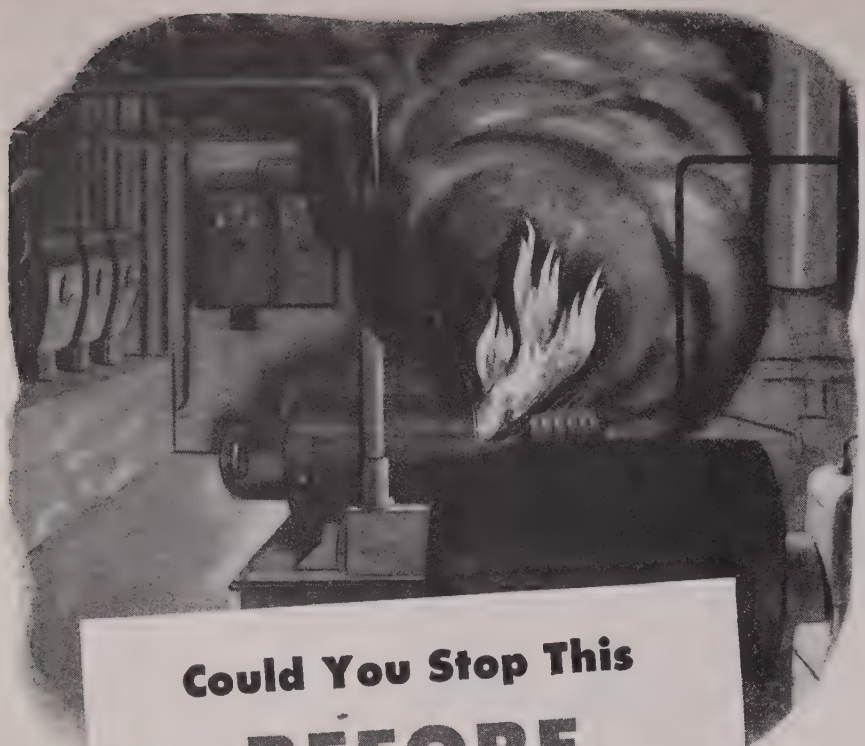
You can be sure of finding the profitable solution to your cleaning problems by actual test. Your products to be cleaned are submitted to exhaustive tests in the Wheelabrator Laboratory . . . the largest and most complete department of its kind in the blast cleaning industry. As a result you are assured of equipment that will do the most thorough cleaning job at the lowest cost.

WRITE FOR FREE BULLETIN

The new bulletin "Cleaning Problems Solved in the Manufacture of Radiators and Boilers" contains many helpful suggestions on profitable cleaning. Send now for your copy.

American
WHEELABRATOR & EQUIPMENT CORP.
(FORMERLY AMERICAN FOUNDRY EQUIPMENT CO.)
510 S. Byrkit St., Mishawaka 3, Indiana

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT



Could You Stop This

BEFORE

It Stopped Your Business?

● You try to foresee everything that might interfere with production, then bang!—You get hit hard by something that was always there, threatening, but you were too busy to figure the gamble. Stop a moment and ask yourself: What would one bad fire *tomorrow* do to the company? What is the key spot, which, if knocked out, would lose most time to put back in operation?

Cardox CO_2 means amazingly quick extinguishment, eliminating or reducing fire damage *with no extinguishment damage.* From single locations to complete plant systems, Cardox assures all the CO_2 needed to put out the fire. Skillfully engineered equipment applies it efficiently in pounds or tons.

Check into the application of this positive protection to your particular hazards by writing today for Bulletin No. 219

CARDOX offers all THREE

• EXTINGUISHMENT
Cardox engineered applications give carbon dioxide enhanced effectiveness for faster, surer extinguishment of large or small fires, indoors or out.

• PREVENTION
Cardox Atmosphere Inerting Systems provide low-cost inert gas for continuous fire and explosion protection.

• DETECTION
Cardox Detection Systems, actuated by heat, smoke or flame, operate as a warning device or to actuate fire extinguishing systems.

CARDOX

CO_2 FIRE EXTINGUISHING SYSTEMS

CARDOX CORPORATION • 307 N. Michigan Avenue, Chicago 1, Illinois

District Offices: New York • Philadelphia • Cleveland • Pittsburgh • Detroit • St. Louis • Los Angeles San Diego • San Francisco

No. 1 Heavy Melting Scrap at Philadelphia

(per gross ton)

	1929	1937	1938	1939	1940	1941
January	$16.39	$17.37	$14.75	$15.25	$18.00	$20.50
February	16.39	18.50	14.75	15.25	17.38	20.00
March	16.13	19.60	14.55	15.38	17.12	20.00
April	17.00	20.00	13.37	15.62	16.75	19.00
May	16.39	18.62	12.13	15.25	17.56	18.75
June	16.00	17.20	12.20	15.41	19.69	18.75
July	16.50	19.00	13.63	15.62	18.95	18.75
August	16.50	19.75	14.35	18.25	19.56	18.75
September	16.39	19.00	14.25	18.87	20.50	18.75
October	15.70	16.38	14.75	22.35	20.70	18.75
November	15.00	13.75	14.75	20.75	20.75	18.75
December	14.50	14.25	15.12	18.92	20.85	18.75
Average	16.07	17.78	14.05	17.08	18.98	19.13

		1944	1945	1946	1947	1948
January		$18.75	$18.75	$18.75	$31.00	$42.50
February		18.75	18.75	18.75	33.38	41.50
March		18.75	18.75	18.75	39.38	40.80
April	1943	18.75	18.75	18.75	33.10	41.50
May	1942	18.75	18.40	18.75	29.69	42.31
June	price fixed	18.75	18.25	18.75	33.63	42.50
July	at	18.75	18.75	18.75	38.45	43.12
August	$18.75	18.60	18.75	18.75	38.50	45.00
September		16.66	18.75	18.75	36.80	45.00
October		14.60	18.75	18.75	40.25	45.00
November		15.50	18.75	22.94	42.63	44.75
December		18.50	18.75	28.00	41.10	44.50
Average		17.01	18.68	19.87	36.50	43.20

No. 1 Machinery Cast Scrap at Cincinnati

(per gross ton)

	1929	1934	1936	1937	1938	1939
January	$17.14	$9.50	$11.37	$15.75	$11.25	$13.75
February	17.24	9.50	11.75	16.12	10.87	13.75
March	17.19	10.00	12.40	17.30	11.05	14.38
April	17.19	10.00	12.19	17.37	10.62	13.56
May	17.19	9.45	11.50	14.44	10.25	12.00
June	17.19	9.00	11.20	14.00	10.10	12.13
July	17.19	9.00	11.19	14.87	11.75	12.25
August	17.05	8.88	12.43	16.25	12.65	12.80
September	16.98	8.75	13.60	14.25	12.31	15.38
October	16.92	8.75	14.00	13.38	12.31	19.55
November	16.57	8.88	14.00	11.85	13.15	18.88
December	16.52	9.85	15.12	10.75	13.88	17.75
Average	17.03	9.30	12.56	14.69	11.68	14.68

	1940	1941†		1946	1947	1948*
January	$17.65	$22.75		$20.00	$34.00	$60.00
February	16.69	22.50		20.00	35.38	66.75
March	16.25	‡22.50		20.00	47.00	63.70
April	16.05	....	1945†	20.00	45.60	63.50
May	16.88	....	1944	20.00	43.25	63.50
June	19.38	....	1943	20.00	44.88	63.50
July	18.65	....	1942 price	20.00	46.50	64.75
August	18.75	....	fixed	20.00	45.50	67.00
September	20.12	‡22.50	at	22.50	44.50	67.00
October	20.55	22.50	$20.00	25.00	45.50	65.50
November	21.00	22.50		26.25	50.38	65.50
December	22.50	22.50		30.80	53.80	65.50
Average	18.71	....		22.05	44.67	64.68

*Average of No. 1 cupola cast prices.

‡ In transition from open market quotations to OPA price maximums, this grade not quoted. However, in September, the maximum schedules were revised to include this grade.

† Ceiling price does not include delivery costs.

Stainless Steel Sheets, No. 304

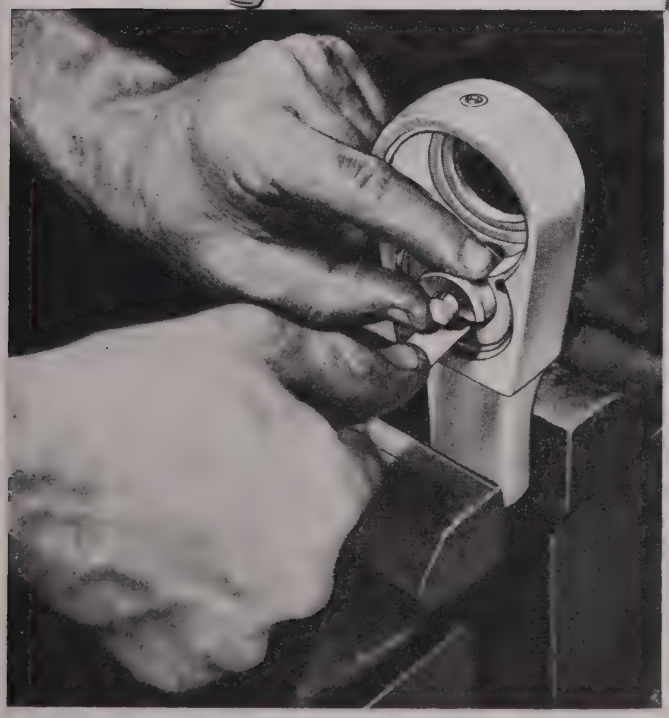
(cents per pound)

	1937		1946	1947	1948
January	35.00		38.00	38.95	39.00
February	35.00	1945	38.00	39.00	39.00
March	36.00	1944	38.00	39.00	39.00
April	36.00	1943	38.21	39.00	39.00
May	36.00	1942	38.95	39.00	39.00
June	36.00	1941	38.95	39.00	39.00
July	36.00	1940 1939	38.95	39.00	39.00
August	36.00	1938	38.95	39.00	40.80
September	36.00	price	38.95	39.00	40.37
October	36.00	fixed	38.95	39.00	40.81
November	36.00	at	38.95	39.00	41.25
December	36.00	36.00	38.95	39.00	41.25
Average	35.90		38.15	38.99	39.79

Why Some Men

STAY MARRIED TO WRENCHES

Improved performance and minimum bulk make these nickel alloy steel Snap-on ratchet wrenches favorites throughout industry.



PAWL BEING ASSEMBLED IN RATCHET HEAD. Use of nickel alloy steel and extraordinary care in machining these parts, assure free working action at all times.

All hand tools have to be able to take punishment, partly from their wide use by inexperienced operators and also because of the necessity of withstanding high unit stresses in normal services.

Take ratchet wrenches for example . . . they are usually operated under heavy pull. The working parts require good impact and fatigue properties and must nevertheless be made from a readily machinable steel. In view of the thin sections employed, the material must be relatively "foolproof" in heat treatment. Hence the frequent adoption of nickel alloy steels for wrench components.

In the rachet wrenches shown above, designed and developed by SNAP-ON TOOLS CORPORATION, Kenosha, Wisc., nickel alloy steel Type 3250 provides not only essential toughness and strength . . . but also insures long-lasting, hard edges on ratchet gears and pawls.

Both improved performance and ready response to fabrication are derived from nickel alloy steels. Write for our recommendations regarding the best types for your products or equipment.

SMBLEM OF INCO SERVICE

TRADE MARK

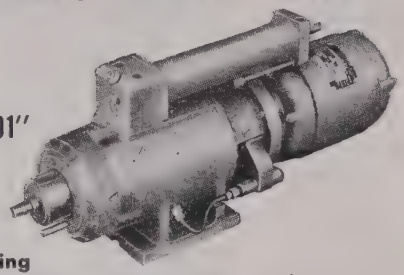
Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

...*"All ingenious things are simple"*

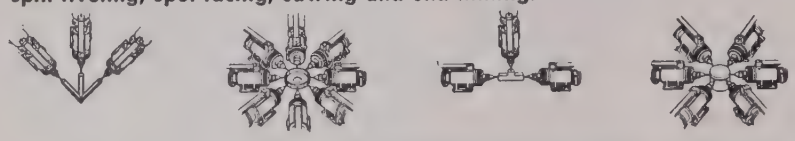
THE NEW AIR-HYDRAULIC

"CLEVELAND REPUBLIC" DRILL UNIT



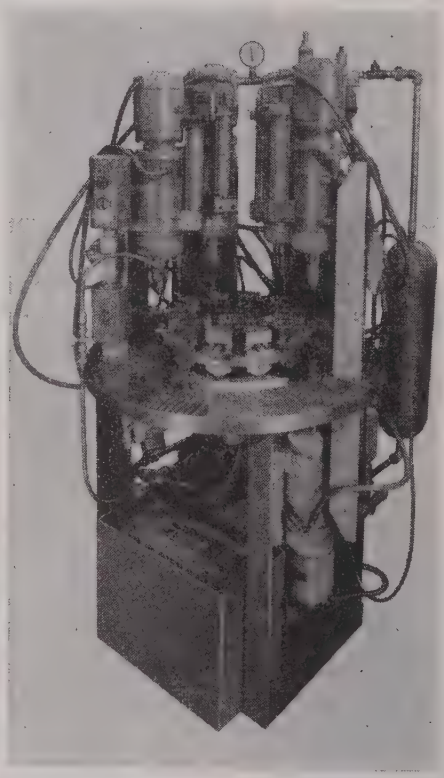
1. Compact...Only 4 Moving Parts
2. Sealed Motor and Head
3. Micrometer Controlled Depth to .001"
4. Holds Spindle Runout to .0005"
5. Built-in Automatic Cycling Switch

The ingenious simplicity of engineering design in the CRT Power Unit brings a lifetime of performance in many production operations. Use its' controlled power for drilling, chamfering, spin-riveting, spot facing, sawing and end milling.



CAN WE REDUCE YOUR COSTS?

The Union Chain & Mfg. Co. of Sandusky, Ohio gained three free operations by using five CRT Model 250 Drill Units. Formerly four single spindle presses were used to drill cross pin holes. Now this one machine does the entire job, drilling in SAE 2320 steel, the pin diameter varying from .234 to .562 and the drill size from .086 to .191, cycle time 2½ sec., the rate being between 600-1500 pieces per hour.



Special drilling machine for Union Chain and Mfg. Co.

"CLEVELAND REPUBLIC" SPECIAL MACHINERY

The building of special machinery has been an outstanding performance of Cleveland Republic Tool Corporation, who design special machinery or build to your specifications. Write for further information, there is no obligation to get the recommendations of our engineers on special machinery design and application.

SEND FOR OUR HANDBOOK OF IDEAS

CLEVELAND REPUBLIC TOOL CORPORATION

General Sales Office, Main Plant and Foundry Division

9613 Meech Avenue, Cleveland 5, Ohio • Detroit Office, 6305 Second Blvd.

No. 1 Machinery Cast Scrap at Chicago

(per gross ton‡)

	1929	1934	1936	1937	1938	1939
January	$15.81	$9.50	$12.00	$15.87	$12.50	$12.56
February	16.25	9.50	12.75	16.25	12.19	12.75
March	16.00	9.50	13.10	17.40	11.65	12.75
April	16.00	9.50	12.50	17.12	10.88	12.12
May	15.39	8.90	12.00	15.25	10.75	11.75
June	14.75	7.50	12.00	15.00	10.45	12.15
July	14.50	8.05	12.12	15.75	12.00	12.25
August	14.50	8.00	13.37	16.55	13.35	12.25
September	14.50	8.00	13.60	14.38	13.00	14.50
October	14.50	8.00	14.00	13.18	12.25	16.87
November	13.63	8.25	14.00	11.65	12.60	15.65
December	13.50	9.65	14.75	12.12	12.50	14.50
Average	15.11	8.69	13.02	15.04	12.01	13.34

	1940	1941†		1946	1947	1948
January	$14.00	$18.88		$20.00	$43.38	$68.00
February	13.75	19.25		20.00	44.56	65.25
March	13.56	20.75		20.00	46.00	68.50
April	14.81	‡22.33	1945†	20.00	42.70	73.12
May	16.31	21.40	1944	20.00	38.00	72.50
June	17.31	20.00	1943	20.00	41.81	69.90
July	16.75	20.00	1942 price	20.00	46.00	71.50
August	16.88	20.00	fixed	20.00	49.38	74.30
September	17.13	20.00	at	22.50	49.50	71.25
October	17.75	20.00	$20.00	25.00	51.00	69.87
November	18.00	20.00		32.28	52.75	72.20
December	19.13	20.00		41.05	60.30	69.50
Average	16.28	20.21		23.40	47.12	70.48

‡ Changed from net ton basis Apr. 30, 1941.
† Ceiling price does not include delivery costs.

Furnace Coke, Connellsville

(net ton at oven)

	1929	1938	1939	1940	1941	1942
January	$2.75	$4.00	$3.75	$4.20	$5.50	$6.13
February	2.90	4.00	3.75	4.00	5.50	6.00
March	2.98	4.00	3.75	4.00	5.52	6.00
April	2.78	4.00	3.75	4.00	5.63	6.00
May	2.75	4.00	3.75	4.00	6.00	6.00
June	2.75	3.85	3.75	4.00	6.13	6.00
July	2.75	3.75	3.75	4.20	6.13	6.00
August	2.73	3.75	3.75	4.63	6.13	6.00
September	2.65	3.75	4.25	4.75	6.13	6.00
October	2.65	3.75	4.90	4.75	6.13	6.00
November	2.65	3.75	5.00	5.10	6.13	6.00
December	2.63	3.75	5.00	5.38	6.13	6.00
Average	2.75	3.86	4.09	4.42	5.92	6.01

	1943	1944	1945	1946	1947	1948
January	$6.00	$7.00	$7.00	$7.50	$8.75	$12.50
February	6.25	7.00	7.00	7.50	8.88	12.50
March	6.50	7.00	7.00	7.50	9.00	12.50
April	6.50	7.00	7.00	7.50	9.60	12.50
May	6.50	7.00	7.15	7.50	10.50	12.50
June	6.50	7.00	7.50	7.50	10.50	12.70
July	6.50	7.00	7.50	8.50	11.40	13.68
August	6.50	7.00	7.50	8.75	12.00	14.75
September	6.50	7.00	7.50	8.75	12.00	15.00
October	6.50	7.00	7.50	8.75	12.38	15.00
November	6.50	7.00	7.50	8.75	12.50	15.00
December	6.60	7.00	7.50	8.75	12.50	15.00
Average	6.45	7.00	7.30	8.10	10.83	13.63

Foundry Coke, Connellsville

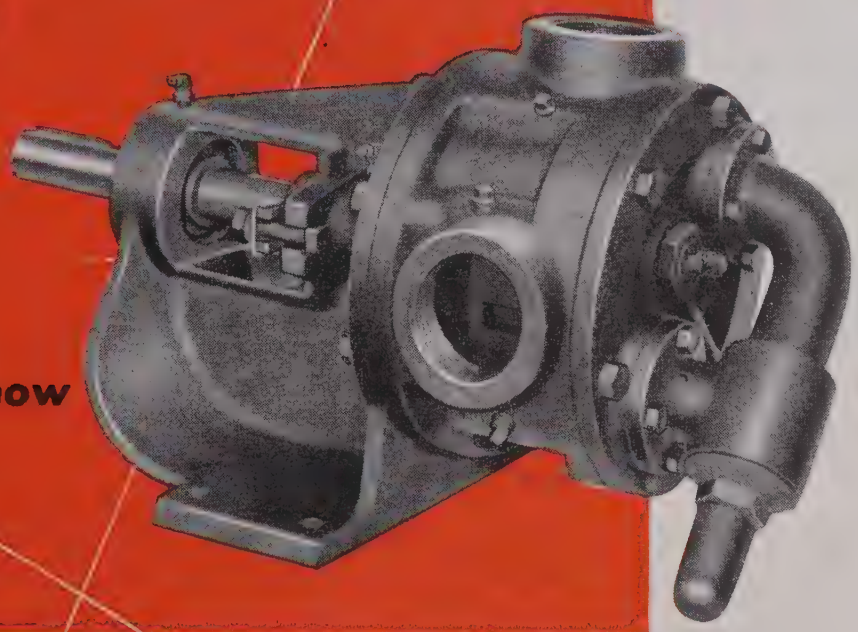
(net ton at oven)

	1929	1938	1939	1940	1941	1948
January	$3.75	$5.00	$4.75	$5.50	$5.75	$8.82
February	3.75	5.00	4.75	5.31	5.75	6.88
March	3.75	5.00	4.75	5.25	5.85	6.88
April	3.75	5.00	4.75	5.25	5.62	6.88
May	3.75	5.00	4.75	5.25	6.72	6.88
June	3.75	4.85	4.75	5.25	6.88	6.88
July	3.75	4.75	4.75	5.25	6.88	6.88
August	3.75	4.75	4.75	5.25	6.88	6.88
September	3.75	4.75	5.12	5.25	6.88	6.88
October	3.75	4.75	5.65	5.25	6.88	6.88
November	3.75	4.75	5.75	5.68	6.88	6.88
December	3.50	4.75	5.75	5.75	6.88	6.88
Average	3.73	4.86	5.02	5.35	6.49	6.88

	1943	1944	1945	1946	1947	1948
January	$6.88	$8.06	$8.25	$9.00	$8.50	$14.00
February	7.13	8.25	8.25	9.00	9.38	14.00
March	7.38	8.25	8.25	9.00	10.25	14.00
April	7.38	8.25	8.25	9.00	10.65	14.00
May	7.44	8.25	8.47	9.00	11.25	14.00
June	7.50	8.25	9.00	9.00	11.25	16.00
July	7.50	8.25	9.00	9.68	12.75	16.50
August	7.50	8.25	9.00	8.50	13.75	17.00
September	7.50	8.25	9.00	8.50	13.75	17.00
October	7.50	8.25	9.00	8.50	13.94	17.00
November	7.50	8.25	9.00	8.50	14.00	17.00
December	7.50	8.25	9.00	8.50	14.00	17.00
Average	7.39	8.24	8.71	8.85	11.96	15.62

only 2 parts move

in this low-cost liquids-mover!



available now

Yes, there are only two moving parts in Fairbanks-Morse Rotary Pumps. These exceptionally compact liquids-movers, with their simplicity of design, bring you low-cost pumping at high efficiency. A precision-cut rotor and pinion do all the work. There are no complicated parts to cause trouble . . . no worries about suction leaks . . . no vapor locks.

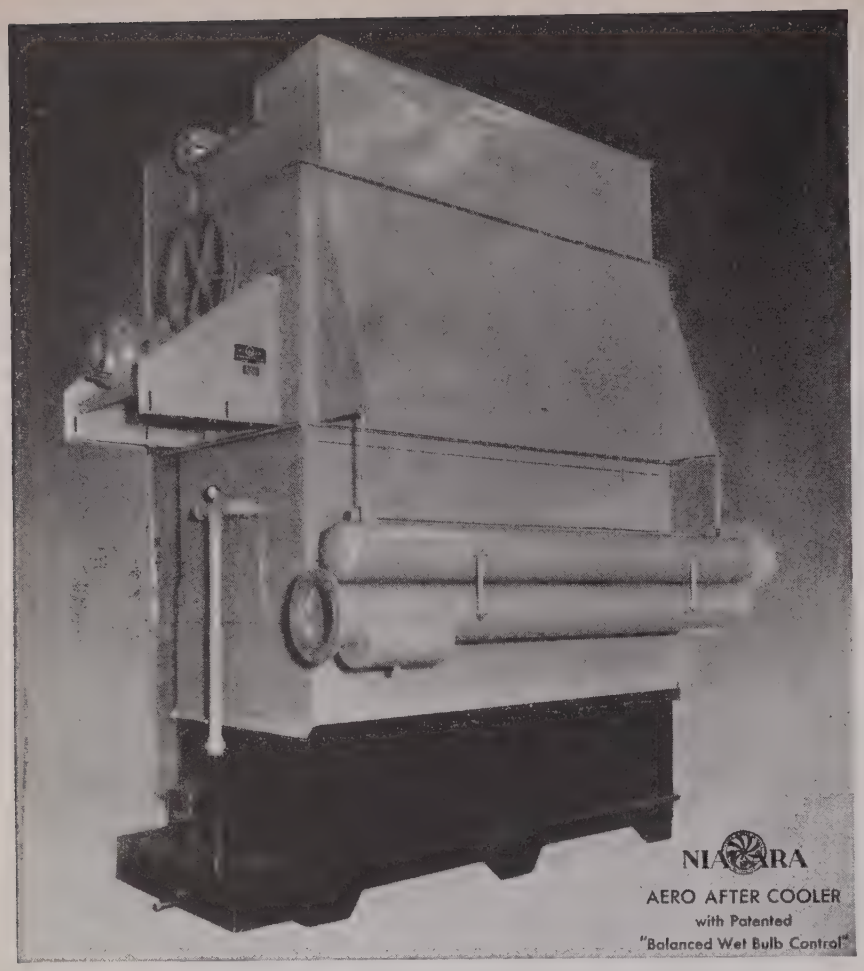
Mixing tanks, laundry and dry cleaning machinery, machine tools, wherever you use one of these positive acting pumps, you can be sure of definite rated output. There is a constant pumping action . . . no vibration or shocks to affect pump life. Most sizes and modifications are available from stock. Fairbanks, Morse & Co., Chicago 5, Illinois.

when it comes to pumps . . .

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES MOTORS • GENERATORS • STOKERS • MAGNETOS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT



How to PREVENT CONDENSATION in COMPRESSED AIR LINES

● Users of pneumatic tools and machinery spend thousands of dollars on repairs and suffer much interruption to production from the condensation of water in their air lines. In compressed gas systems and in processes where compressed air is blown directly on parts and materials in production, there is additional damage.

You can prevent these losses by installing a Niagara Aero After Cooler. It cools the compressed air or gas by evaporative cooling and removes the water before the air enters the receiver. This method brings the air to within a few degrees of the wet bulb temperature, making certain that your compressed air will always be colder than the atmosphere surrounding the lines in your plant, so that no further condensation can take place.

Savings in cooling water pay for the installation. Experience shows that the patented Niagara evaporative cooling method consumes less than 5% of the water required for cooling by conventional means. You save the cost of the water, the cost of pumping it, the cost of disposing of it. These extra savings soon pay for the Niagara Aero After Cooler.

Write for Bulletin No. 98 IA

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

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District Engineers in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Electrolytic Copper, Conn. Valley

(cents per pound)

	1929	1933	1934	1936	1937	1938
January	16.84	5.00	8.18	9.25	12.66	10.42
February	18.05	5.00	8.00	9.25	13.60	10.00
March	21.38	5.26	8.00	9.25	15.99	10.00
April	19.93	5.68	8.39	9.40	15.35	10.00
May	18.00	6.93	8.50	9.50	14.00	9.60
June	18.00	8.00	8.82	9.50	14.00	9.00
July	18.00	8.91	9.00	9.60	14.00	9.81
August	18.00	9.00	9.00	9.75	14.00	10.12
September	18.03	9.00	9.00	9.75	13.78	10.25
October	18.00	8.25	9.00	9.85	12.06	10.98
November	18.00	8.18	9.00	10.43	11.02	11.25
December	18.00	8.12	9.00	11.00	10.24	11.25
Average	18.35	7.28	8.66	9.71	13.39	10.22

	1939	1940		1946	1947	1948
January	11.25	12.22		12.00	19.56	21.50
February	11.25	11.40		12.00	19.75	21.50
March	11.25	11.38	1945	12.00	21.50	21.50
April	10.47	11.33	1944	12.00	21.50	21.50
May	10.06	11.32	1943	12.00	22.63	21.50
June	10.00	11.37	1942	14.28	21.63	21.50
July	10.22	10.81	1941 price	14.375	21.50	21.50
August	10.49	10.95	fixed	14.375	21.50	23.43
September	11.93	11.54	at	14.375	21.50	23.50
October	12.44	12.00	12.00	14.375	21.50	23.50
November	12.50	12.00		17.19	21.50	23.50
December	12.50	12.00		19.50	21.50	23.50
Average	11.20	11.53		14.04	21.30	22.33

Zinc at New York

(cents per pound)

	1929	1934	1936	1937	1938	1939
January	6.70	4.62	5.22	6.20	5.35	4.89
February	6.70	4.73	5.23	6.80	5.17	4.89
March	6.80	4.72	5.27	7.75	4.77	4.89
April	7.04	4.72	5.27	7.70	4.53	4.89
May	6.98	4.71	5.27	7.10	4.43	4.89
June	7.00	4.59	5.26	7.10	4.53	4.89
July	7.10	4.68	5.16	7.27	5.14	4.91
August	7.15	4.63	5.17	7.56	5.14	5.11
September	7.15	4.43	5.22	7.54	5.24	6.51
October	7.09	4.19	5.22	6.45	5.40	6.89
November	6.63	4.08	5.35	5.98	5.12	6.89
December	6.09	4.06	5.64	5.36	4.89	6.46
Average	6.87	4.51	5.27	6.90	4.98	5.51

	1940	1941		1946	1947	1948
January	6.03	7.65		8.65	11.005	11.69
February	5.93	7.65		8.65	11.005	12.61
March	6.14	7.65		8.65	11.005	12.61
April	6.14	7.65	1945	8.65	11.005	12.61
May	6.20	7.65	1944	8.65	11.005	12.64
June	6.63	7.65	1943	8.65	11.005	12.65
July	6.64	7.65	1942 price	8.69	11.005	13.09
August	6.79	7.65	fixed	8.69	11.005	15.65
September	7.33	7.65	at	8.69	11.005	15.65
October	7.64	8.36	8.65	9.28	11.03	15.74
November	7.64	8.65		10.86	11.06	17.27
December	7.65	8.65		10.94	11.06	18.15
Average	6.73	7.88		9.09	11.02	14.19

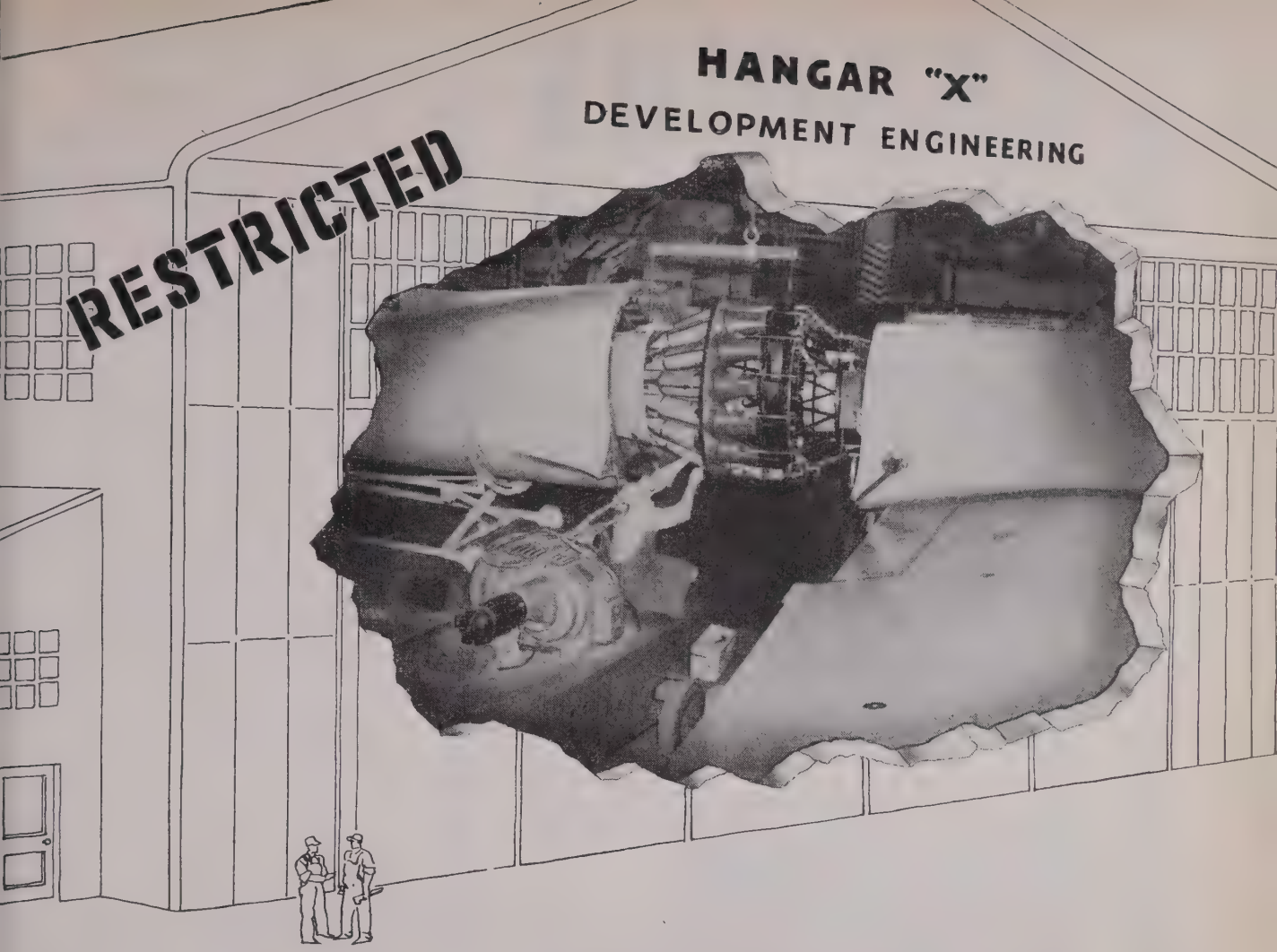
Aluminum, 99 Pct Plus

(cents per pound, freight allowed)

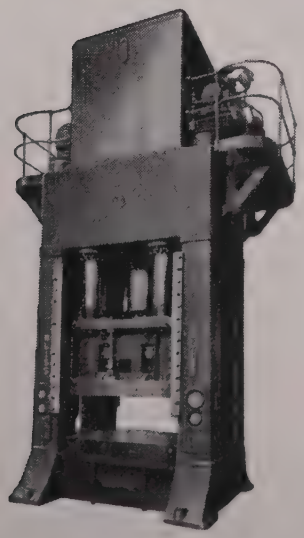
	1929	1932	1933	1934	1936	1937
January	23.90	23.30	23.30	23.30	20.50	20.50
February	23.90	23.30	23.30	21.65	20.50	20.50
March	23.90	23.30	23.30	21.65	20.50	20.00
April	23.90	23.30	23.30	21.65	20.50	20.00
May	23.90	23.30	23.30	21.65	20.50	20.00
June	23.90	23.30	23.30	21.65	20.50	20.00
July	23.90	23.30	23.30	21.65	20.50	20.00
August	23.90	23.30	23.30	21.65	20.50	20.00
September	23.90	23.30	23.30	21.65	20.50	20.00
October	23.90	23.30	23.30	21.49	20.50	20.00
November	23.90	23.30	23.30	20.50	20.50	20.00
December	23.90	23.30	23.30	20.50	20.50	20.00
Average	23.90	23.30	23.30	21.58	20.50	20.08

	1938	1939	1940	1941		1948
January	20.00	20.00	20.00	17.00		15.00
February	20.00	20.00	20.00	17.00	1947	15.00
March	20.00	20.00	20.00	17.00	1946	15.00
April	20.00	20.00	19.00	17.00	1945	15.00
May	20.00	20.00	19.00	17.00	1944	15.00
June	20.00	20.00	19.00	17.00	1943	15.00
July	20.00	20.00	19.00	17.00	1942 price	16.00
August	20.00	20.00	18.00	17.00	fixed	16.00
September	20.00	20.00	18.00	17.00	at	16.00
October	20.00	20.00	18.00	15.00	15.00	16.70
November	20.00	20.00	17.50	15.00		17.00
December	20.00	20.00	17.00	15.00		17.00
Average	20.00	20.00	18.71	16.50		15.66

(*Continued on p. 358*)



BLISS is in this picture, too!



Special press engineering for one aircraft builder produced this 1,000-ton Bliss Hydro-Dynamic Press—a double action machine for deep drawing work.

Inside the hangar they're writing the "specs" for supersonic planes. And that includes new metals—tough austenitic steels and other alloys for parts moving at faster speeds and hotter temperatures than ever before.

That's where Bliss comes on the scene. For the aircraft industry is another of Bliss' familiar "stamping grounds." Here Bliss has always provided the pioneering plane builders with the vital means of production—the power press equipment to blank, form, squeeze and draw the hundreds of metal parts required.

Yes, if "producibility" of your aircraft design is a problem, Bliss engineers can help. They bring to every conference table a fund of metal working and development engineering experience that goes back over 90 years. They'll dare to pioneer with you in designing press equipment especially suited for the job at hand.

That's why Bliss presses predominate throughout the pressed metal field: the aircraft, automotive, railroad, electrical, and many other industries...that's why presses for the toughest jobs are *Bliss-built*...that's why your problem will be nearer solution by sending for a Bliss sales engineer.

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Mechanical and Hydraulic Presses • Rolling Mills • Container Machinery

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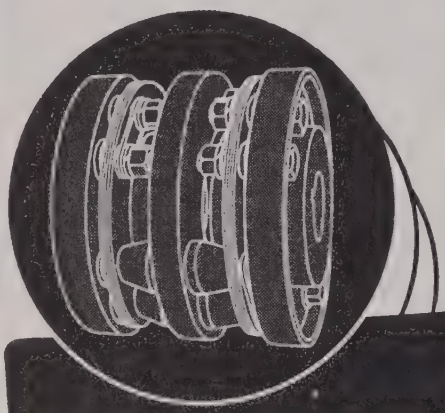
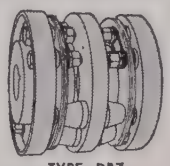
MARQUETTE • BLISS • CONSOLIDATED • TOLEDO
BLISS BUILT

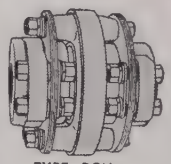
THOMAS *Flexible* COUPLINGS

.... are specified by engineers, wherever 100% Operating Efficiency is demanded

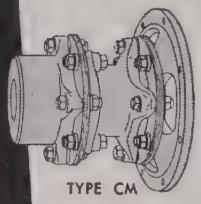




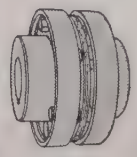
TYPE DBZ



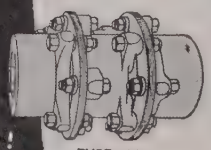
TYPE DSM



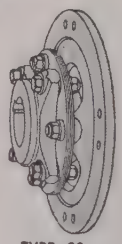
TYPE CM



TYPE ST



TYPE AM



TYPE SS

THOMAS *Flexible* COUPLINGS

provide for

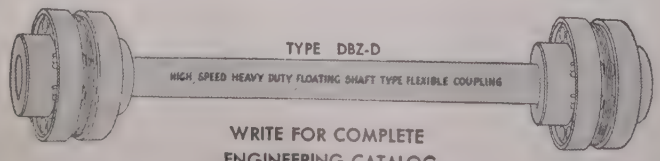
Angular and Parallel Misalignment as well as Free End Float . . .

and Eliminate

BACKLASH, FRICTION, WEAR and CROSS-PULL

NO LUBRICATION IS REQUIRED!

The Thomas All-Metal Coupling does not depend on springs, gears, rubber or grids to drive. All power is transmitted by direct pull.



WRITE FOR COMPLETE ENGINEERING CATALOG

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA

University of Chicago Seeks Basic Knowledge In Little Known Fields

Chicago

• • • **Dec. 2, 1942,** marked a memorable day in Chicago. In fact, it is one of the most important dates in history as on that day the first self-sustaining nuclear chain reaction achieved by man took place under the stands of Stagg Field at the University of Chicago campus. What is taking place in the nuclear studies at the University 6 years later is even more exciting.

So far 15 large industrial companies have chipped in many thousands of dollars to back the research at the University. When they joined they weren't sure what they were going to get out of it as participating members, but if the broad scope of the basic research now taking place in many fields at the University, continues as fast as it has to date, they are going to get their money's worth.

One of the basic units of the new center is the synchrocyclotron which is now under construction and is expected to be in operation in 1950. This, when completed, will be the most powerful atom smasher in the country. Bethlehem Steel, one of the participating members in the peacetime atomic and metal research program, furnished large forgings for this machine.

The heart of the giant synchrocyclotron is a 4,140,000 lb magnet. More than 4 miles of copper tubing are being used and this coil will carry 3000 amp of current. The copper tubing is in the form of 2-in. squares which have a 1⅛-in. hole drilled in the center. Through the center is circulated water when the instrument is in operation so as to keep the whole machine cooled to the proper temperature.

Ammunition for the atom smasher will be protons which will be accelerated to speeds very close to that of light. In the vacuum chamber surrounded by the magnet these invisible particles will be operating in a field of about 450 million electron volts and at this speed the particles are capable of penetrating a foot of solid aluminum. The scientists in charge of this machine told THE IRON AGE that the electronic voltage to be

WHY WELD, CLINCH OR STAKE NUTS?

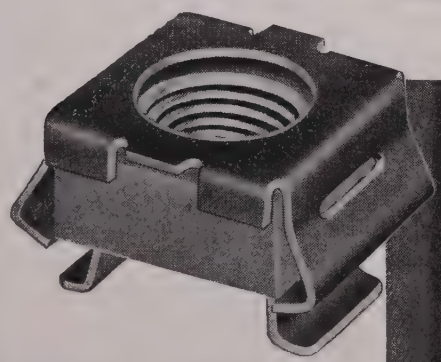
JUST SNAP IN *Speed Grips**

Now you can attach square nuts to metal parts *by hand!* Just thumb pressure snaps the *new* SPEED GRIP Nut Retainers in place. SPEED GRIPS, like many SPEED NUTS, have spring steel "mechanical hands" that lock them in bolt-receiving position. They are ideal for blind assembly attachments because SPEED GRIPS do not have to be held with a wrench.

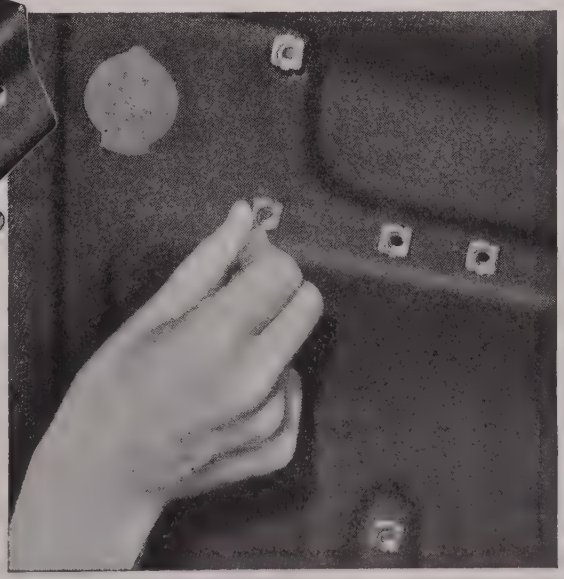
Developed as a companion item to the famous Tinnerman SPEED NUTS, the SPEED GRIP Nut Retainer gives all the self-retaining advantages of SPEED NUTS in applications requiring square nut attachments.

Write for the details on this latest Tinnerman development. The savings it can make in equipment investment in assembly steps, in material handling and in parts costs will surprise you. And ask your Tinnerman representative about our Fastening Analysis Service. Tinnerman Products, Inc., Cleveland 13, Ohio.

In Canada: Dominion Fasteners Limited, Hamilton
In England: Simmonds Aerocessories, Ltd., Treforest
In France: Aerocessoires Simmonds, S. A., Paris



New Tinnerman SPEED GRIPS are available in a complete range of sizes. Screw size and panel range are stamped on each fastener.



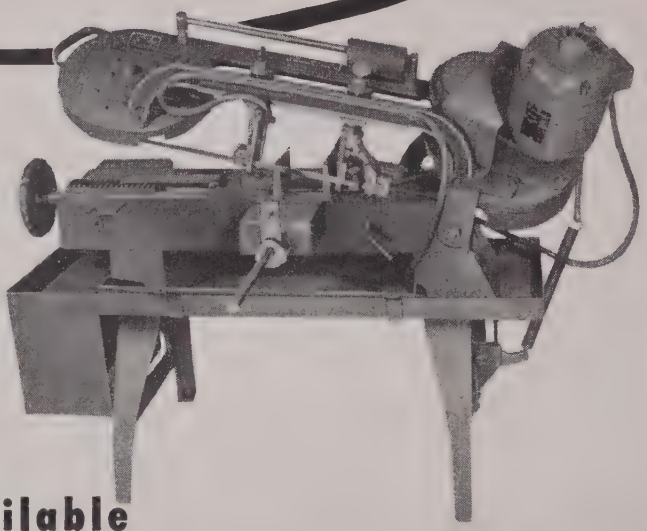
Here's how SPEED GRIPS can be applied to panels on the moving assembly line. In a few seconds, assembler can snap in self-aligning SPEED GRIPS . . . no extra handling . . . no special equipment required!

TINNERMAN *Speed Nuts*

*Trade Mark Reg. U. S. Pat. Off.

MORE THAN 4000 SHAPES AND SIZES

BIG saw performance in a compact, economical package



the WELLS No. 5 METAL CUTTING BAND SAW now available with wet cutting system...

The advantages of wet cutting, previously available only on larger machines, can now be had on the Wells No. 5 Utility Model Metal Cutting Band Saw. This proved-in-service system reduces cutting costs by reducing cutting time and permitting more cuts per blade. Self-contained and compact, the Wells Wet Cutting System is completely automatic with convenient controls, and does not interfere with portability. Factory-assembled on new machines or available for installation on your present machine. Get full details from your Wells Dealer or write direct.

Wells No. 8 and No. 12 Saws are available for jobs requiring larger capacity.

Design Details
Wells No. 5 Saw

- ✓ 5" x 10" rectangular capacity; 5" dia., rounds.
- ✓ Three speeds: 60, 90, 130 ft./min.
- ✓ ⅓ H.P. motor.
- ✓ Quick-acting swivel vise.
- ✓ Fast, accurate, and economical.

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
202 WASHINGTON AVE., THREE RIVERS, MICH

used with the synchrocyclotron is very close to that at which Einstein's theory of relativity starts to become a problem.

The Research Institute is divided into three sections with the Institute of Metals of most interest to the industries that have signed up so far. The institute is studying the nature of metals and all solids in general. Fundamental studies in chemical, electrical and mechanical properties of copper, magnesium, steel, aluminum and other substances are now well underway. Dr. Cyril Smith is applying the knowledge gained from a study of soap bubble formation in the attempt to better understand grain structure of metals.

Equipment just built at the institute includes apparatus capable of producing liquid hydrogen and helium. Both helium 3 and 5 are being studied. Equipment to be installed in the new buildings now going up will enable the institute to test many substances at temperatures ranging from 7000°F to virtually absolute zero, —273°F. It will also be possible to take X rays and photographs of the various metals under these conditions.

The Institute of Radiobiology and Biophysics is studying problems ranging from the nature of viruses to the fundamental process of plant, animal and human growth. Members of this institute are conducting studies on the effects of radiation on all biological systems and even abnormal systems such as cancer.

Among the most interesting experiments to be conducted is Dr. Raymond E. Zirkle's effort to discover which part of the cell governs division. For these tests Dr. Zirkle will use a proton microbeam with a diameter of only .0025 in. to bombard microscopic parts of cells. Results of this research may have an important bearing on the nature of cancerous growths.

The third division of the institute, Institute for Nuclear Studies, now has under study atomic nuclei and fundamental particles of matter. Scientists in this institute are trying to find out what this binding force is which holds the protons and neutrons of an atom's nucleus together. In their cosmic ray research they are constantly sending balloons into the stratosphere and taking photographic plates of cosmic ray.

Simonds *INDUSTRIAL* Gears

SIMONDS has been a good name to remember for industrial gears of popular types and sizes in all materials for more than 50 years. Today . . . more than ever . . . you should look to SIMONDS for the latest in proved gear advancements and seasoned craftsmanship. SIMONDS specializes in large diameter gears —Spur Gears up to 145" dia.—Bevel and Mitre Gears up to 60" dia.—Worm Gears up to 72" dia. All materials, too—cast or forged steel, gray iron, bronze, silent steel, rawhide or bakelite. Send SIMONDS your inquiries for industrial gears to meet your most critical requirements.

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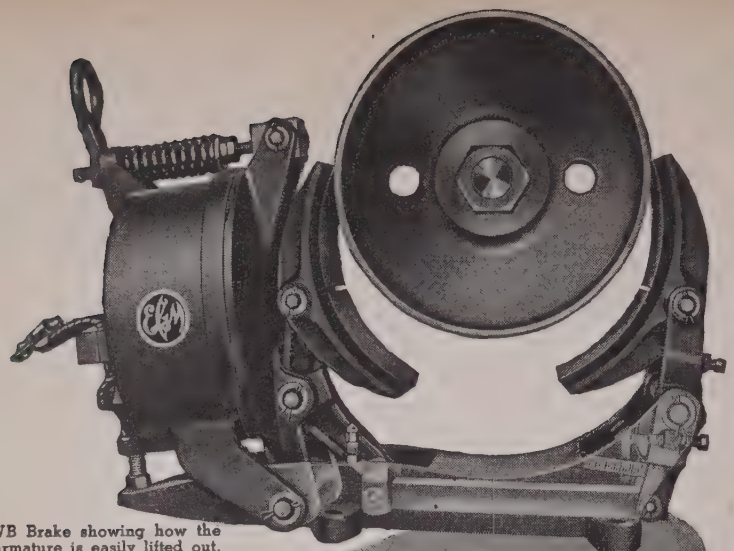
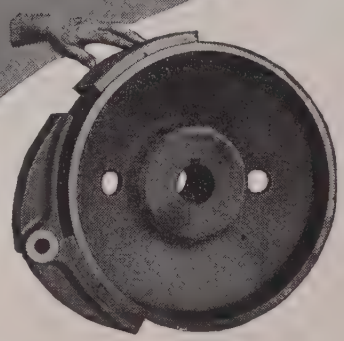
Distributors for RAMSEY Silent Chain Drives and Couplings



Type WB Brake showing how the motor armature is easily lifted out. At top left is the handle-nut for compressing the spring when removing motor armature, changing brake shoes and for manual control.

Long Life Brakes for A-C and D-C Motors by EC&M

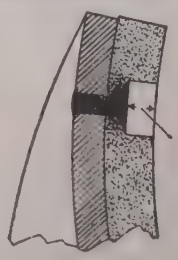


The brake lining is molded to match curvature of wheel and shoe.

These Type WB Brakes for a.c. and d.c. service have a block type lining which is both thick and tough.

Furthermore, due to the process of manufacture, the blocks have proper frictional quality *throughout the entire thickness* permitting uniform and complete wear down to rivet heads. And since the material is non-compressionable, brake adjustments are infrequent.

EC&M Type WB Brakes are built in several sizes. They can be supplied with series or shunt-wound operating coils for direct current motors. On alternating current service, they are supplied in shunt-wound form for use with a compact rectifier-unit. Send for Bulletins 1004 and 1006 describing these long life brakes.



Actual wearing thickness, between rivet heads and brake wheel, is ⅛" on the smallest size to ½" on the largest size.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

PRICES AND PRODUCTION

Lead at New York

(cents per pound)

	1929	1934	1936	1937	1938	1939
January	6.65	4.00	4.50	6.00	4.87	4.83
February	6.85	4.00	4.51	6.23	4.63	4.80
March	7.41	4.00	4.60	7.19	4.50	4.82
April	7.19	4.18	4.60	6.32	4.50	4.78
May	7.00	4.14	4.60	6.00	4.40	4.75
June	7.00	3.98	4.60	6.00	4.15	4.80
July	6.80	3.77	4.60	6.00	4.88	4.85
August	6.75	3.75	4.60	6.45	4.90	5.04
September	6.88	3.68	4.60	6.40	5.00	5.45
October	6.87	3.65	4.63	5.75	5.10	5.50
November	6.29	3.57	5.11	5.03	5.09	5.50
December	6.25	3.60	5.55	4.87	4.84	5.50
Average	6.83	3.86	4.71	6.02	4.74	5.05

	1940	1941		1946	1947	1948
January	5.47	5.50		6.50	13.00	15.00
February	5.08	5.60		6.50	13.25	15.00
March	5.19	5.77		6.50	15.00	15.00
April	5.07	5.85	1945	6.50	15.00	17.21
May	5.02	5.85	1944	6.50	15.00	17.50
June	5.00	5.85	1943	8.18	15.00	17.50
July	5.00	5.85	1942 price	9.18	15.00	17.80
August	4.85	5.85	fixed	8.25	15.00	19.50
September	4.93	5.85	at	8.25	15.00	19.50
October	5.31	5.85	6.50	8.25	15.00	19.50
November	5.73	5.85		10.41	15.00	21.50
December	5.50	5.85		12.20	15.00	21.50
Average	5.18	5.79		8.10	14.69	18.04

Grade A Tin at New York

(cents per pound)

	1929	1934	1936	1937	1938	1939
January	49.21	51.98	47.23	50.90	41.54	46.39
February	49.39	51.78	47.94	52.10	41.23	45.64
March	48.85	53.84	48.00	62.74	41.16	46.17
April	45.93	55.66	46.97	59.02	38.41	47.16
May	43.88	53.57	46.31	55.64	36.83	49.00
June	44.20	51.31	42.24	55.88	40.36	48.81
July	46.29	51.94	42.96	59.34	43.38	48.53
August	46.60	51.99	42.57	59.40	43.26	48.80
September	45.32	51.52	44.77	58.64	43.40	Nom.
October	42.25	51.01	44.95	51.52	45.25	55.68
November	40.18	51.24	51.30	43.34	46.29	52.65
December	39.87	50.92	51.85	42.96	46.21	51.40
Average	45.16	52.23	46.42	54.29	42.28	49.11

	1940	1941		1946	1947	1948
January	46.73	50.16		52.00	70.00	94.00
February	45.85	51.41		52.00	70.00	94.00
March	47.07	52.07		52.00	70.00	94.00
April	46.96	52.03	1945	52.00	80.00	94.00
May	51.51	52.18	1944	52.00	80.00	94.00
June	54.64	52.68	1943	52.00	80.00	$1.03
July	51.61	53.41	1942 price	52.00	80.00	1.03
August	51.21	52.45	fixed	52.00	80.00	1.03
September	50.30	52.00	at	52.00	80.00	1.03
October	51.50	52.00	52.00	52.00	80.00	1.03
November	50.57	52.00		61.00	80.00	1.03
December	50.11	52.00		70.00	85.38	1.03
Average	49.84	52.03		54.00	77.95	99.25

50 Pct Ferrosilicon

(carloads, per gross ton, delivered†)

	1929	1937	1938	1939	1940	
January	$83.50	$69.50	$69.50	$69.50	$69.50	
February	83.50	69.50	69.50	69.50	69.50	
March	83.50	69.50	69.50	69.50	69.50	
April	83.50	69.50	69.50	69.50	69.50	
May	83.50	69.50	69.50	69.50	69.50	1942
June	83.50	69.50	69.50	69.50	72.00	1941 price
July	83.50	69.50	69.50	69.50	74.50	fixed
August	83.50	69.50	69.50	69.50	74.50	at
September	83.50	69.50	69.50	69.50	74.50	$74.50
October	83.50	69.50	69.50	69.50	74.50	
November	83.50	69.50	69.50	69.50	74.50	
December	83.50	69.50	69.50	69.50	74.50	
Average	83.50	69.50	69.50	69.50	72.11	

	1943	1944	1945	1946	1947	1948
January	$74.50	6.65	6.65	6.65	7.45	9.80
February	74.50	6.65	6.65	6.65	7.45	9.80
March	74.50	6.65	6.65	6.65	7.45	9.80
April	74.50	6.65	6.65	6.65	7.80	9.80
May	74.50	6.65	6.65	6.65	7.80	9.80
June	74.50	6.65	6.65	6.65	7.80	9.80
July	6.65	6.65	6.65	7.05	7.80	9.80
August	6.65	6.65	6.65	7.05	7.80	9.80
September	6.65	6.65	6.65	7.05	7.80	9.80
October	6.65	6.65	6.65	7.05	8.80	10.50
November	6.65	6.65	6.65	7.05	8.80	10.50
December	6.65	6.65	6.65	7.05	9.18	10.50
Average	6.65	6.65	6.65	6.85	7.99	9.98

* Cents per lb of contained Si. since July 1943.
† Delivered east of Mississippi only, prior to Oct. 7, 1948.

Temporary Outdoor Storage

Don't half-mechanize...

GO ALL THE WAY
in Materials Handling

Going all the way means using power industrial trucks of the RIDDEN type. It means putting speed into your wheels—*3 times faster* than a hand-led truck.

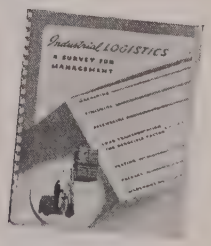
It means handling *much larger* loads—loads that can be efficiently and safely high-tiered, or wheeled outside the department entirely, yet as accessible as if they had remained there.

It means *savings in man-hours*—savings that are vital with common labor scarce and almost prohibitive in cost.

Transportation is the product of tonnage by time. Why not save both instead of one? Don't ask your walking-talking operator to be pushed around by a machine—*put him on it, where it's safe; make him master of the whole job.*

Elwell-Parker builds power industrial trucks of the RIDDEN type *only.* Have an EP man show you how "Going All The Way" will substantially cut your materials handling costs. The Elwell-Parker Electric Company, 4225 St. Clair Ave., Cleveland 14, O.

FREE BOOKLET ON SCIENTIFIC MATERIALS HANDLING



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POWER INDUSTRIAL TRUCKS
Established 1893

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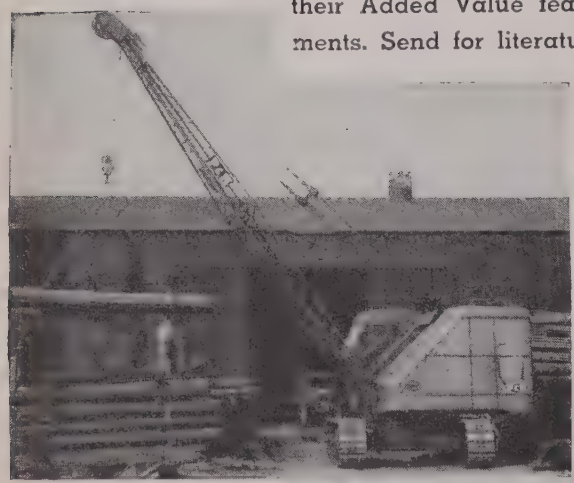
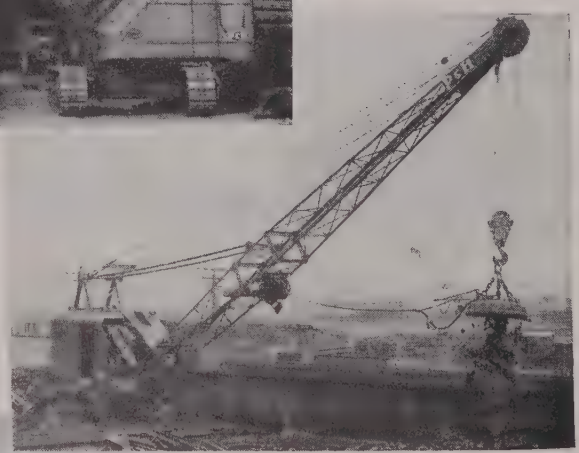
FASTER, SAFER, AT A SAVING!

Have you the handling efficiency outside your plant that you have inside? P&H Crawler Cranes can give you fast, flexible, versatile yard service with one-man operation — to speed materials handling. P&H Crawler Cranes with their Added Value features are wise investments. Send for literature!



CRAWLER

P&H Crawler Cranes are easy to operate because of P&H's smooth, responsive hydraulic control. You can operate them in close quarters because of P&H's exclusive and simplified method of steering and braking.



MAGNET

Equipped with magnet, the P&H Crawler Crane loads scrap quickly. For those countless lifting jobs in plant yards, you can make no better choice than a P&H. Its construction of rolled alloy steels means extra long, trouble-free service.

CLAMSHELL

Bulk materials are moved speedily and easily with a P&H Crawler clamshell and movement is not restricted to inplace trackage. In addition P&H clear-view, all-weather cabs permit year-round operation.

P&H INDUSTRIAL CRAWLER CRANES
4401 West National Avenue
Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION

There's a P&H Industrial Crawler Crane to Meet Your Requirements. Write Today for Bulletins!

Southern No. 2 Foundry Pig Iron at Birmingham

(per gross ton*)

	1929	1936	1937	1938	1939	1940
January	$16.50	$15.50	$17.38	$20.38	$17.38	$19.38
February	16.50	15.50	17.68	20.38	17.38	19.38
March	16.00	15.50	19.93	20.38	17.38	19.38
April	15.40	15.50	20.38	20.38	17.38	19.38
May	15.00	15.50	20.38	20.38	17.38	19.38
June	15.00	15.50	20.38	19.58	17.38	19.38
July	14.63	15.50	20.38	16.38	17.38	19.38
August	14.50	15.88	20.38	16.38	17.38	19.38
September	14.50	15.88	20.38	18.63	18.38	19.38
October	14.50	15.88	20.38	17.38	19.38	19.38
November	14.50	16.13	20.38	17.38	19.38	19.38
December	14.50	16.88	20.38	17.38	19.38	19.38
Average	15.13	15.76	19.87	18.58	17.96	19.38

	1941		1945	1946	1947	1948
January	$19.38		$20.38	$22.13	$26.88	$37.38
February	19.38		20.86	22.13	26.88	37.38
March	19.89		21.38	22.51	29.13	37.38
April	20.38	1944	21.38	22.88	29.88	37.38
May	20.38	1943	21.38	22.88	29.88	38.38
June	20.38	1942	21.38	24.88	29.88	39.38
July	20.38	price fixed	21.38	24.88	31.28	41.04
August	20.38	at	21.38	24.88	34.13	43.38
September	20.38	$20.38	21.38	24.88	34.88	43.38
October	20.38		21.68	24.88	34.88	43.38
November	20.38		22.13	24.88	34.88	43.38
December	20.38		22.13	26.88	34.60	43.38
Average	20.17		21.40	24.06	31.43	40.43

* Subject to 38¢ a ton deduction for 0.70 phosphorus and over.

Lake Superior Charcoal Pig Iron at Chicago

(per gross ton)

	1929	1938	1939	1940	1941	1942
January	$27.04	$30.24	$28.34	$30.34	$30.34	$31.34
February	27.04	30.24	28.34	30.34	30.34	31.34
March	27.04	30.24	28.34	30.34	30.34	31.34
April	27.04	30.32	28.34	30.34	30.34	31.34
May	27.04	30.34	28.34	30.34	31.09	31.34
June	27.04	30.34	28.34	30.34	31.34	31.34
July	27.04	28.34	28.34	30.34	31.34	31.34
August	27.04	28.34	28.34	30.34	31.34	31.34
September	27.04	28.34	29.34	30.34	31.34	31.34
October	27.04	28.34	30.34	30.34	31.34	31.34
November	27.04	28.34	30.34	30.34	31.34	31.34
December	27.04	28.34	30.34	30.34	31.34	31.34
Average	27.04	29.31	28.92	30.34	30.99	31.34

	1943	1944	1945	1946	1947	1948
January	$31.34	$37.34	$37.34	$42.34	$42.99	$61.21
February	31.34	37.34	37.34	42.34	42.99	62.46
March	31.34	37.34	41.09	42.34	45.24	62.46
April	31.34	37.34	42.34	42.34	45.99	62.46
May	31.34	37.34	42.34	42.34	45.99	63.27
June	31.34	37.34	42.34	42.34	45.99	65.55
July	31.34	37.34	42.34	42.34	47.01	67.55
August	31.34	37.34	42.34	42.34	49.49	69.55
September	37.34	37.34	42.34	42.34	49.49	69.55
October	37.34	37.34	42.34	42.34	52.77	73.78
November	37.34	37.34	42.34	42.34	56.04	73.78
December	37.34	37.34	42.34	42.60	56.04	73.78
Average	33.34	37.34	41.40	42.36	48.34	67.11

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• • An extensive listing of additional price quotations and production statistics will be found in the regular weekly issues of THE IRON AGE.

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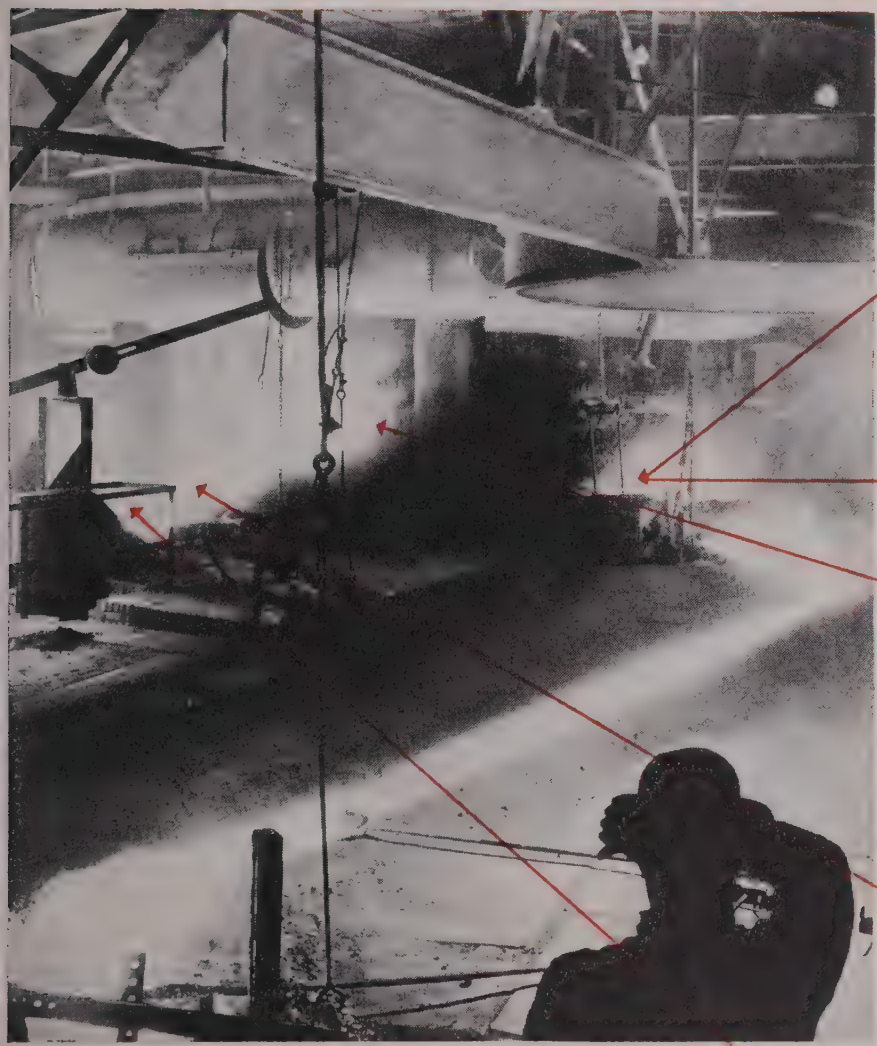
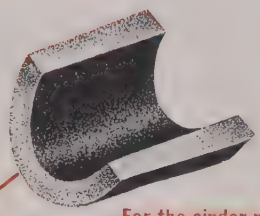
WHEREVER THE HOT STUFF HITS

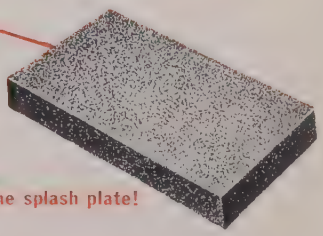
USE CARBON





For the cinder notch liner!

For the cinder notch plug!



For the splash plate!

For the runout troughs!

For the skimmer plate!

● "National" carbon is now firmly established for blast furnace linings. It is being used outside the furnace as well—wherever there is contact with molten material—for the splash plate, runout troughs clear down to the ladle, skimmer plate, cinder notch liner, and cinder notch plug.

The reasons?

"National" carbon has no melting point. It is highly resistant to slag attack and thermal shock . . . not wet by molten metal . . . has a low thermal expansion . . . and maintains its mechanical strength at elevated temperatures.

Use "National" carbon inside and outside your blast furnaces and you cut down maintenance, speed up production and save money. For more information, write to National Carbon Company, Inc., Dept. IA.

The term "National" is a registered trade-mark of National Carbon Company, Inc.

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Unit of Union Carbide UCC *and Carbon Corporation*

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Division Sales Offices:

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These products sold in Canada by Canadian National Carbon Company, Ltd., Toronto 4

.020" Round Holes
in 28-Gauge Brass

2.5" Round Holes
in 15/16" Steel

On the same day, recently, Hendrick received orders requiring the punching of .020" round holes in 28-gauge brass and 2.5" round holes in 15/16" steel. This is typical of the range of perforations Hendrick is regularly called upon to furnish. When required perforations can even be made as large as 8" in diameter.

Hendrick is prepared to perforate to your specifications any suitable gauge of any commercially rolled metal, with any desired shape and size of opening. With over seventy years of experience in this work, Hendrick offers an unsurpassed stock of tools and dies, and ample plant facilities.

The Hendrick plant is also fully equipped to fabricate from perforated metal a wide range of products which involve such operations as shaping, forming, welding, riveting or brazing.

Write for detailed information.

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Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
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HENDRICK
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Guaranty Trust Co. Sees Bleaker Fiscal Outlook

New York

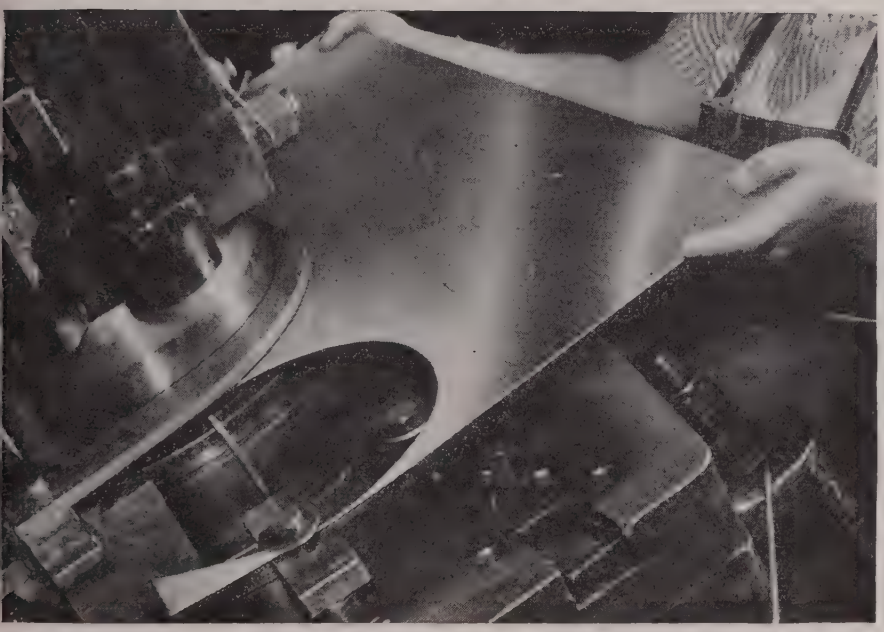
• • • **"The victors** in the national election apparently regard the vote of the people as a mandate in favor of the broad political, social and economic ideas that have guided Federal policy for the last 16 years. Whether this interpretation is correct or not, it is clear that the current aspects of that policy, as set forth by the President and other officials, have taken on a new significance to those who conduct business affairs," states the Guaranty Trust Co. of New York in the current issue of *The Guaranty Survey,* its monthly review of business and financial conditions.

"Among the questions of most immediate concern is that of measures to combat inflation. Events seem to have proved that the country is not prepared to face the rigors and perils of a vigorous and thoroughgoing anti-inflationary program. If this is the case, it would be better to face it squarely than to continue toying with superficial remedies of a supposedly painless but destructive character.

"With respect to fiscal policy, the oustanding fact is that the Administration now being returned to office has never shown a real determination to reduce the cost of government or an adequate appreciation of the gravity of the existing tax burden. Here, again, the extent to which the outlook might have been changed by a different election outcome is uncertain. All that can be said with confidence is that there is no clear prospect of reduction in nonessential Federal expenditures or of official recognition of the need for encouraging the flow of venture capital into industry.

"With expenditures for national defense and foreign aid almost certain to continue at high levels for several years at least, the necessity for economy in other divisions of the federal budget is a matter of great urgency. Unless substantial budgetary surpluses can be achieved at present levels of national income without further increases in the already crushing load of taxation, there would seem to be little likelihood that further inflationary increases in the national debt can be avoided over the long term."

Plated Parts Move From Raw Material To Assembly Line In Two Operations

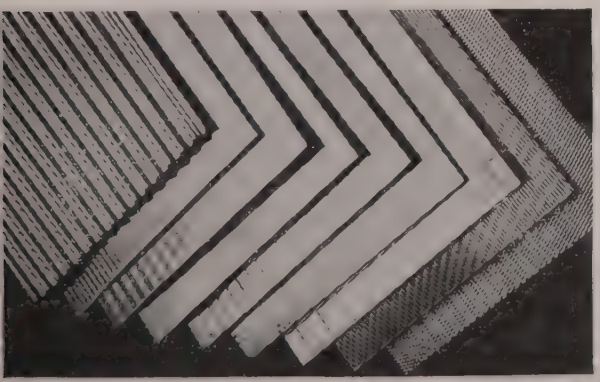


Manufacturing has been simplified in hundreds of plants through elimination of former methods which required cleaning of stamped parts, plating, polishing or other finishing, before going into final assembly. By substituting pre-plated Nickeloid Metals a streamlined, economical result has been achieved. In many plants Nickeloid Metals are (1). Blanked. (2). Stamped or formed. Then assembled. Handling, factory space, and equipment investment has been reduced or eliminated. Nickeloid Metals are available with finishes of Chromium, Nickel, Copper, Brass, Tints, or Gold Bond . . . plated to such base metals as Zinc, Steel, Copper, Brass, or Aluminum. Attractive patterns and finishes, saving other steps, also available.

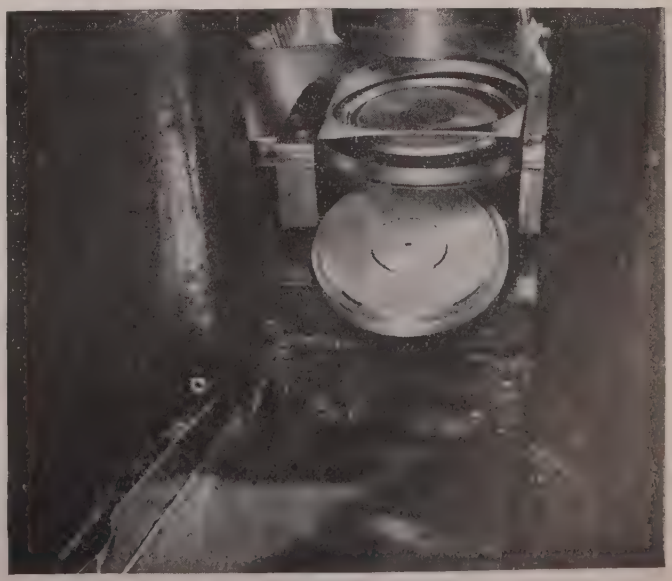
Representative Nickeloid Metals have been put up in an attractive and useful SAMPLER. Send for a copy on your company stationery.

BLANKING First step. With proper dies and good shop practice, the highly plated finish of Nickeloid Metals is not impaired. For unusually severe operations, Mar-Not protective finish is available.

STAMPING Beautiful results are achieved. Nickeloid Metals may also be riveted, soldered, spot welded, seamed, etched. Illustration below shows stamped part after ejection from stamping machine.



The wide variety of finishes and attractive patterns of Nickeloid Metals makes them a source of inspiration to the product designer. The company supplies samples to aid designers in employing these metals.



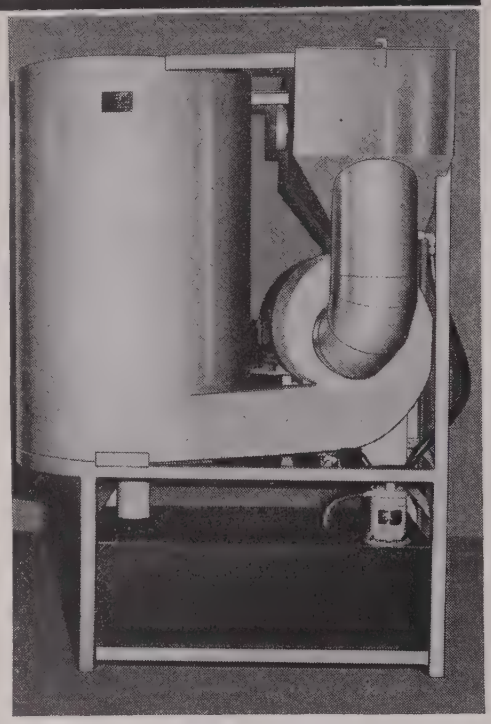
AMERICAN NICKELOID COMPANY
PERU 2, ILLINOIS

Control DUST . . . FUMES

AT LOWER

HEATING
INSTALLATION
MAINTENANCE

COST



Niehaus Dust Separator

The new Niehaus *Dust* Separator is a complete, easily installed unit that employs water action to cleanse the air in your shop of dust and foreign particles produced by polishing, buffing and grinding.

Placed adjacent to machines being exhausted, the Niehaus Dust Separator, by high centrifugal action, thoroughly mixes atomized water with dust-laden incoming air and washes out the entrained foreign matter.

The refuse thus collected goes into a portable tank in the bottom of the unit. The cleansed air is discharged into the room from the top of the machine. Costly heat that normally is discharged out-of-doors is saved by the Niehaus method.

Niehaus Fume Separator

The Niehaus *Fume* Separator controls fumes from your cleaning and plating tanks by the principle of water absorption and centrifugal separation. The Niehaus method has proved so efficient under all shop conditions that many first purchasers quickly modernized their plants completely by installing additional Niehaus Separators.

This revolutionary method allows the entire fume control process to be accomplished alongside your tanks . . . does away with large, expensive blowers; with costly, space-consuming overhead ductwork. The operation requires no outside enclosures, thus conserving your shop's heat.

The cost of Niehaus Separators are low. They are easily and inexpensively installed. Your savings in ductwork alone usually will more than pay for the installing. In addition, you reduce your fuel bill and your maintenance costs.

Niehaus Separators are manufactured in several models and are furnished with either plain or stainless steel chambers. They are applicable for any size installation. Send for illustrated folder which gives complete information and specifications.

Niehaus Separators are distributed by local representatives throughout the United States. Your dealer's name will be supplied on request.

INDUSTRIAL ELECTROPLATING COMPANY, INC.
219 West Vermont Street, Indianapolis 1 4, Indiana

Canada Slated to Set New All Time Record In Steel Production

Ottawa

• • • **Government representatives** here stated that Canada will set a new all-time record this year in the production of steel. Affecting everything from washing machines to new hydro developments, a year's output of 3,100,000 net tons of ingot steel looks like a safe estimate, they said. There is an outside—and improbable—chance the total might come close to 3,200,000 tons.

With industries steadily clamoring for more steel to put into new buildings, new generators, new knives and forks, machinery and equipment, etc., Canada last year produced 2,854,000 tons of ingots. Before the war 1,500,000 net tons of ingots was a good year for the steel industry, and in 1933 the total was below 500,000 tons.

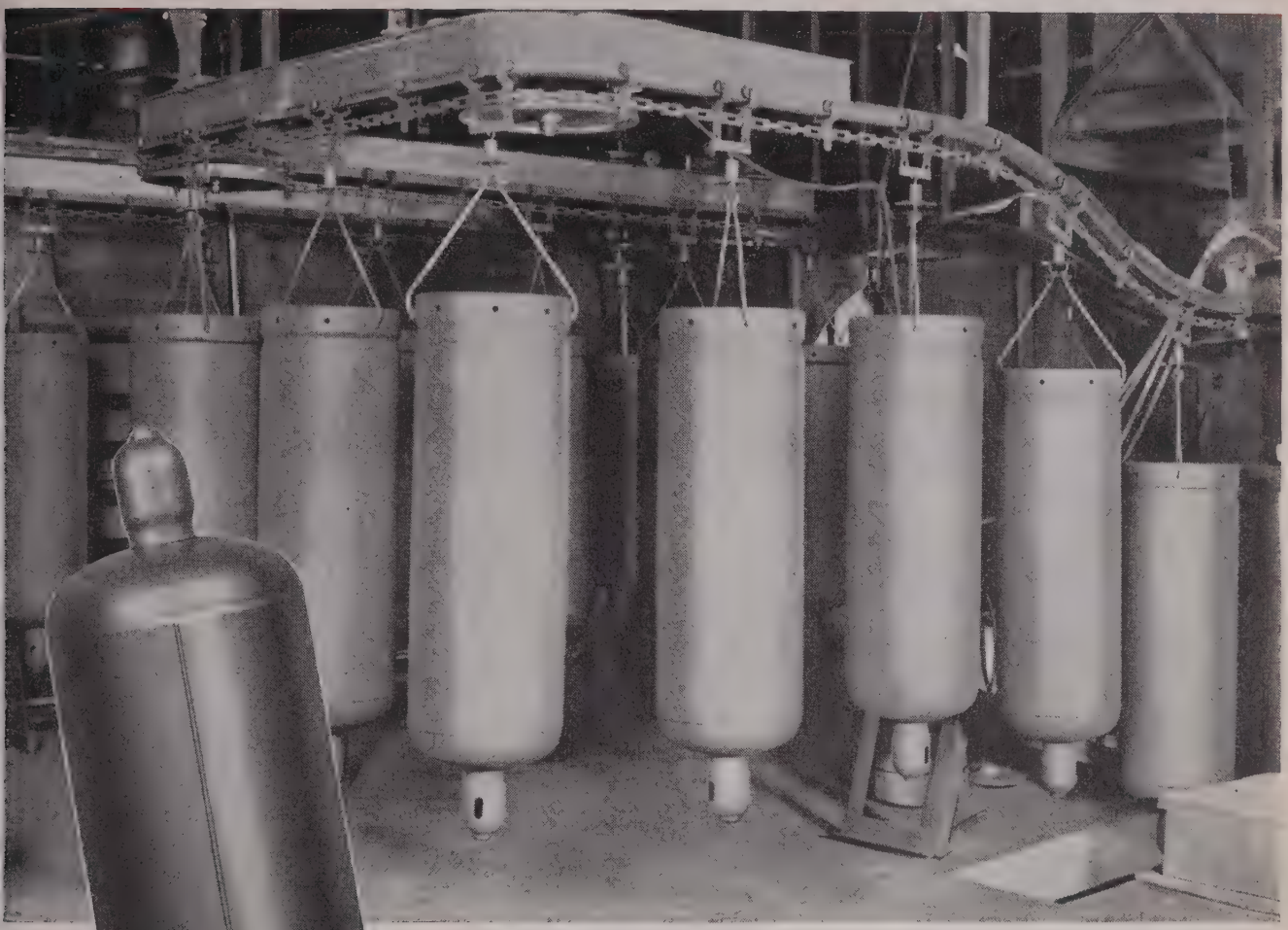
Conversion of ingot steel into the finished shapes in which industry uses it — rods, sheets, structural angles, etc.—involves a loss of about 25 pct. In addition to its own production, Canada will have imported about 900,000 tons of finished rolling mill products from the United States by the end of this year. This represents a decline of about 40,000 tons from 1947. With steel the basic factor in the modern industrial economy, government experts are unable to present as encouraging a picture of 1949 as for this year, when there is already a serious shortage.

Roughly speaking, they said, the country will have somewhat less steel than this year and about as much as there was in 1947. Heavy defense requirements in the next year would cut seriously into the quantity of steel plates now going to producers of peacetime products and capital equipment. Plates, an official said, are the key to the entire steel shortage, since they are never used for non-essential purposes—such as sheet steel—and are already scarce.

About 70 pct of the country's monthly production of 21,000 tons of steel plates are allocated by the federal steel controller for pur-

N-A-X HIGH-TENSILE STEEL in L.P.G. Cylinders

means light weight with added safety and durability



Photographs of the Lee cylinder, courtesy of the Steel Cooperage Company, Detroit.

Because of the greater strength and excellent fabricating, welding and copper brazing properties of this low-alloy, abrasion- and corrosion-resisting steel, cylinders made with it (to conform to I.C.C. safety requirements) are 35% lighter in weight than when made with conventional carbon steel.

This weight reduction (with longer life) means greatly reduced shipping and handling costs . . . and over-all savings to consumers.

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HIGH-TENSILE STEEL

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ENGINEERING B-W PRODUCTION

Most users of Stainless-Clad steel know the 20-year record of IngAclad. Countless applications in all of the Process Industries have proved its dependability and real economy. Where protection has been needed on *both* sides of the metal, Ingersoll solid stainless sheets have also had wide acceptance.

But do you know that Ingersoll heat-resistant steels have also made an outstanding record in such applications as furnaces, ovens, etc., where excessively high temperatures are applied?

INGERSOLL STEEL DIVISION, Borg-Warner Corporation
310 South Michigan Avenue, Chicago 4, Illinois
Plants: Chicago, Illinois; Kalamazoo, Michigan

poses which federal officials believe would continue even with a defense program under way. The remaining 30 pct goes to essential users, too, but without government allocation.

Canadian imports of steel from the United States for the first 3 months of 1949 are expected to be set at 200,000 tons, the same level as for the last quarter of this year. To date, Canada has placed only structural steels under formal import control. Quotas have been given importations of main groups in short supply within the 200,000 ton allocation, but only in the case of structurals was the specific allocation of 35,000 tons put under import control. The same situation is expected to prevail for the first quarter of 1949.

Actual importations of U. S. steel into Canada in the first quarter of 1947 and 1948 were approximately 240,000 tons on the basis used by U. S. officials. This means for 1949 a cutback of 40,000 tons or about 16 pct from what was required in the two previous years. Against this, it is argued that with the shortage of steel as it now exists in the U. S., the figure of 200,000 tons is about the maximum which could have been obtained even without control. No figures are available as yet as to how importations in the last quarter have been keeping within the limits set in the agreement with the U. S. To date no special project authorizations outside the 200,000 tons quota have been sought by Canada.

Last Ship Leaves Kearney

Kearney, N. J.

• • • **The last ship** to leave U. S. Steel's Federal Shipyard here will be the U. S. army transport, *The General Maurice Rose,* which has been undergoing conversion in the yard and is ready to depart.

Announcement that the yard and principal facilities of this subsidiary of U. S. Steel had been sold to the Navy was made last Apr. 21.

The General Rose, a ship of 15,970 gross tons, will be taken over before she leaves the yard by the U. S. Army Transport Service, which will operate the vessel.

Design Ideas to Cut Costs of Wheels, Gear Blanks, Pulleys

THE examples shown are typical of the different ways in which wheels, gear blanks and pulleys are being built with arc welding. These basic designs can be modified to suit your production needs, depending upon the quantity to be made and the kind of fabricating equipment available.

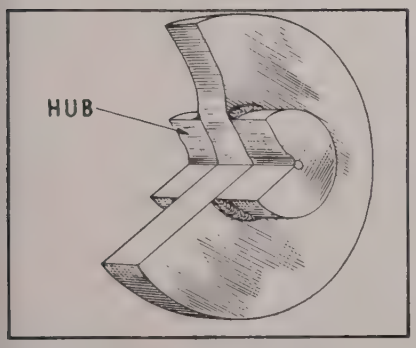


Fig. 1. *Simple gear blank* is made by fillet welding the hub to the web. Parts are flame cut from steel plate.

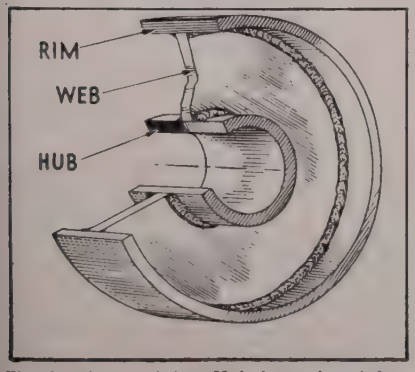


Fig. 2. *Alternate design.* Hub is machined from tubing and rim is rolled from steel strip. Hub and rim are fillet welded to web.

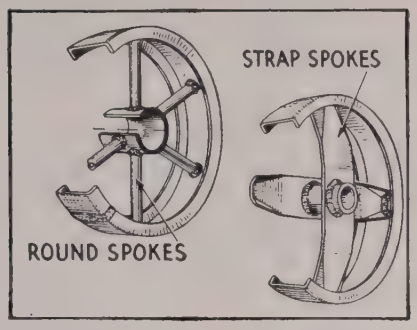


Fig. 3. *Low cost wheel* is made with spokes formed from round bars or steel straps. Spokes are fillet welded inside the channel rim. Hub if required is produced from steel tubing.

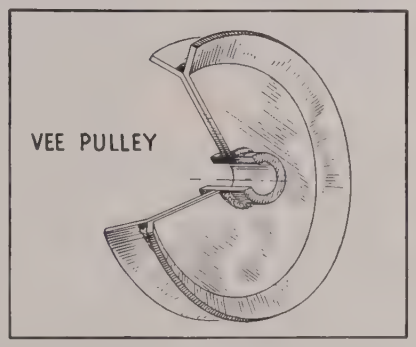


Fig. 4. *Pulley* is fabricated from two steel discs formed to produce a vee-shaped rim.

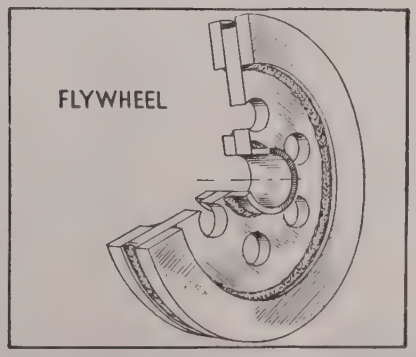


Fig. 5. *Flywheel* is made by welding two steel rims to web by a single groove weld. With welded design, metal is concentrated where it is needed most . . . at the rim.

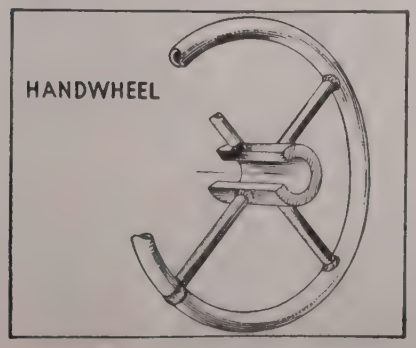
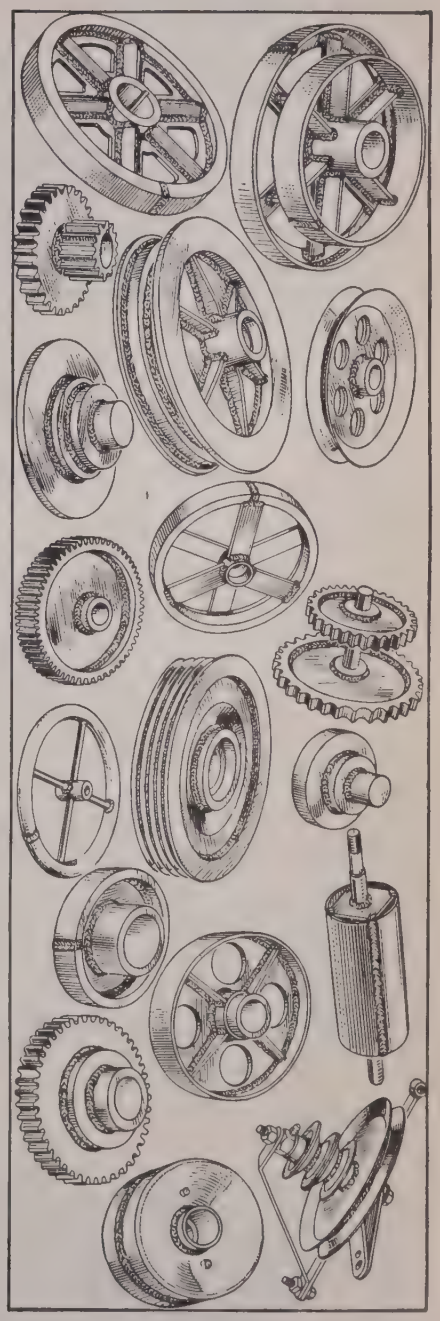


Fig. 6. *Handwheel.* Rim is formed from round bar stock or tubing. Spokes are plain round stock. Steel handwheels will not fracture from impact.



Detailed information on the design of all types of machine parts is contained in the "Procedure Handbook of Arc Welding Design and Practice." Price $1.50 postpaid in the U.S.A.; elsewhere $2.00.

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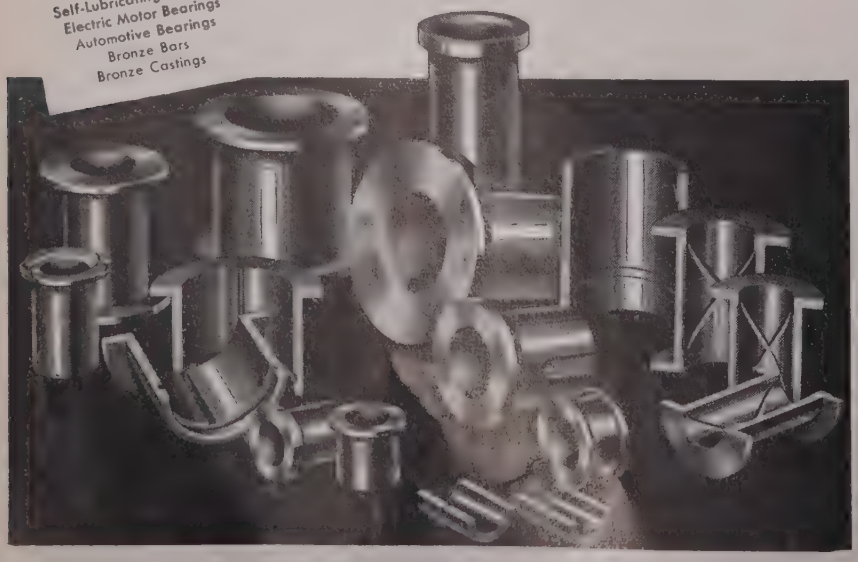

Stream Contamination Reduced by Careful Plant Housekeeping

Jeannette, Pa.

• • • **An example** of efficient handling of a complex waste disposal problem is the plant-wide program currently underway at the Jeannette, Pa., plant of Elliott Co., producers of turbines, condensers, superchargers, centrifugal blowers and other plant and processing equipment. The contaminants that required disposal are several—all common to such operations. They include soluble and lubricating oils, waste pickle liquor and rinse water, and cyaniding quench waters.

It was apparent from the outset that each would require individual handling; yet a plant survey by Hall Laboratories, Pittsburgh consultants on industrial water problems, showed that careful planning and a modest expenditure of money would enable the company to meet its requirements in preventing contamination of near-by Bushy Run, which receives the plant's two waste water flows.

First offender dealt with in the program, which is now nearing completion, was soluble and lubricating oils. It was determined that these oils were being permitted by shop workers to pass into floor drains leading to the plant sewers. Accordingly, drip receivers were installed, and the oily waste thus collected now is dumped on the coal stockpile.

A skim baffle was installed on the spray pond. A third step was the shaping of an earthen basin at the sewer outfall to act as an oil trap in case of accidental oil spills. Finally, provision was made in the plant maintenance work schedule for separate collection of waste soluble oils and disposal of this material on the coal stockpile.

Waste pickle liquors are neutralized in the pickle tank by periodic addition of alkali, with sludge disposal in a lagoon on plant property near-by.

Two underground oil storage tanks, no longer used for their original purpose because of a recent change in fuel, made possible the economical disposal of rinse water. The water is automatically

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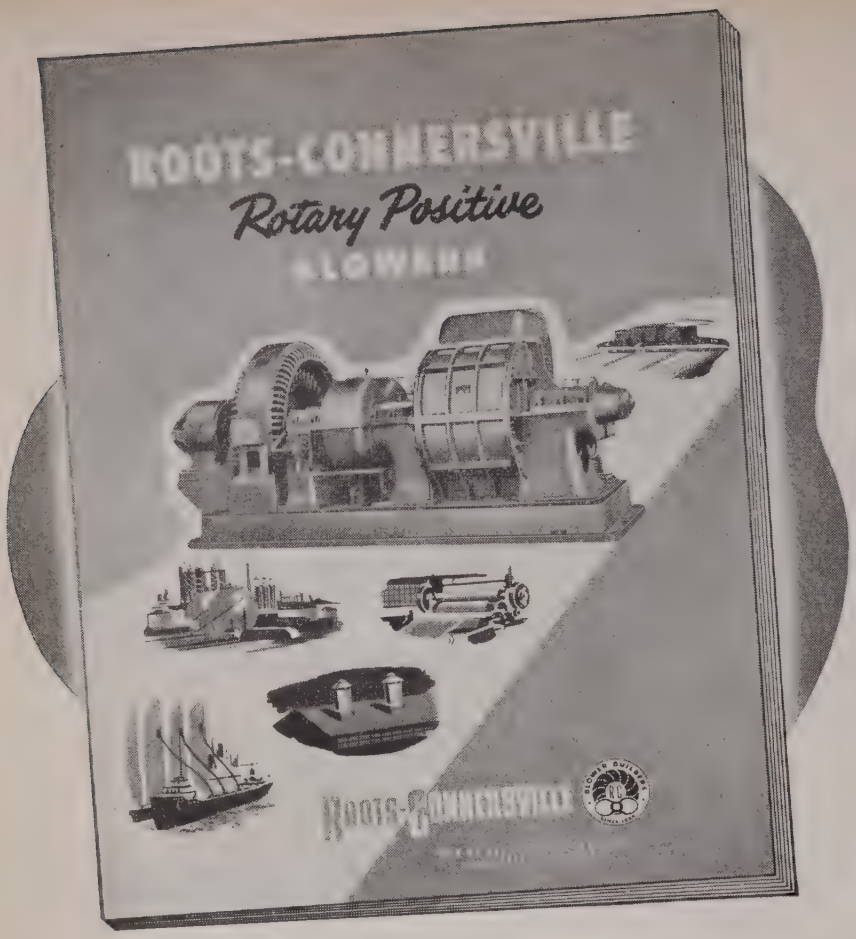

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Gives helpful data and information, including characteristic curves covering capacity and horsepower, to help you in selecting equipment to meet your specific requirements—based on almost a century of specializing in blowers.

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901 Ohio Avenue, Connersville, Indiana

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neutralized during operation, and piped to the tanks. One tank has been adapted for sedimentation and withdrawal of neutralized rinse water through a swing pipe; the other tank is used for concentration and storage of sludge produced by the neutralization of the rinse water. Each morning the swing pipe skims off the supernatant (clear liquid) which then is disposed of in the plant sewerage system.

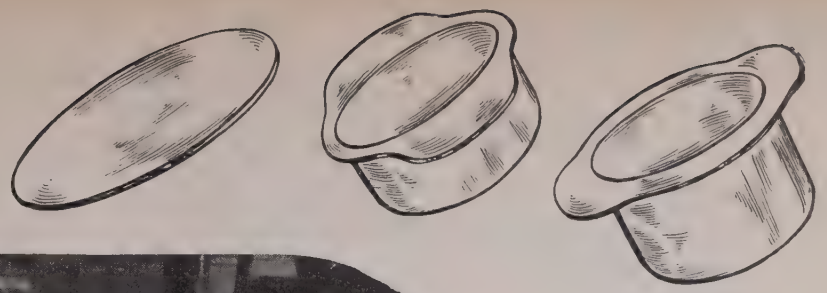
To accomplish neutralization of rinse water, a branch line was installed between the inlet valve and the tank. An educator is in this branch line, which feeds alkali to the rinse tank discharge. Thus whenever the inlet valve of the rinse tank is open, alkali is automatically fed to neutralize acid drag-out.

Care in rinsing and segregation of cyanide rinse water, and separate disposal, proved to be a different problem but not costly or difficult. Formerly, small parts of turbine governors were dipped in cyanide salt baths and quenched with continuous run-over. Normal volume of this operation was about 200 pieces per month. When it was found that the continuous overflow was contaminating the main body of plant waste water (which averages about 300 gpm.), it was decided to switch from continuous rinse to batch rinse. This, in turn, made possible the minimization and segregation of this noxious waste, with separate disposal. Total waste thus disposed of averages about 5 gal per day, 6 days per month.

Finally, it was determined that sodium dichromate, which was formerly employed to prevent corrosion in cooling water circuits on the Elliott dynamometer stands, was having a toxic effect on the plant waste water. Accordingly a non-toxic material, Calgon—a special phosphate glass—was substituted.

Through these changes in operation procedure and by employment of available facilities in the plant, the management reported, major expenditures for oil separation, waste liquor neutralization and cyanide treatment facilities were avoided.

A leading fabricator of deep drawn articles reports a steel loss of only ½ per cent in the manufacture of these soft drink dispensers from Micro-Rold stainless steel.



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Precisely processed, Micro-Rold stainless is held to exceptionally close tolerances throughout entire length and width. These tolerances, as low as 3 per cent of specified thickness, mean less waste and spoilage.

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Temper Grades
301 and 302

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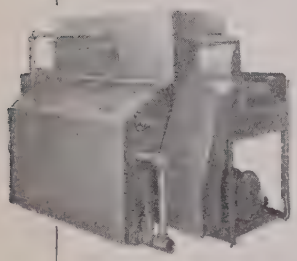
WASHINGTON, PENNSYLVANIA

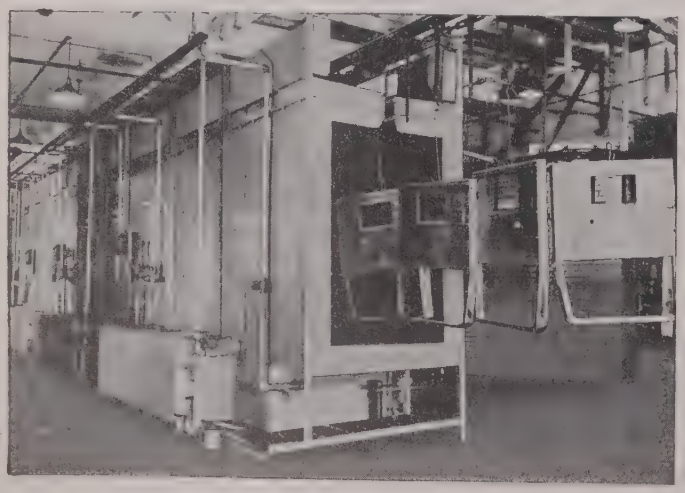
take the DIRTY WORK out of cleaning metal parts



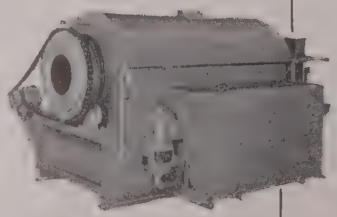
METALWASH Machines will do the "dirty work" for you automatically, without mess or manual handling. Here are some typical examples:

Left, is a belt type washer handling 480 sq. ft. of conveyor surface, or 120 two-feet square baskets of small parts per hour.

Below, is an automatic cleaning, phosphate coating and drying machine preparing over 120 truck body parts per hour for painting. Cab doors, fenders, hoods and pans are carried right on the plant conveyor line.



Right, is a revolving drum type machine, automatically washing and rinsing up to 90 cu. ft. of screw machine products or small stampings per hour.



METALWASH designs and manufactures all types of metal parts washing, pickling and drying equipment, engineered to meet your particular production requirements. If you have a metal cleaning problem let us help you. Write to Dept. D for further information.

METALWASH MACHINERY CORP.
149 - 155 SHAW AVENUE IRVINGTON 11, NEW JERSEY

Open House Held for New Westinghouse Co. Plant

Hillside, N. J.

• • • **The launching** of full-scale operations at the newly-completed Westinghouse Manufacturing and Repair plant was celebrated here recently. More than 1500 persons attended an open house arranged by the company.

The new plant, which replaces a plant in Newark, consists of a factory building, warehouse and 2-story office building. Together the three buildings contain 259,175 sq ft of floor space. This is 72 pct more than the Newark plant which it replaces. The new plant is situated on a 25-acre plot and is served by the Lehigh Valley Railroad.

L. D. Canfield, eastern district manager of the Westinghouse manufacturing and repair department, reported that 560 persons currently are employed at the plant. He estimated that an additional 150 are expected to be hired as operations develop.

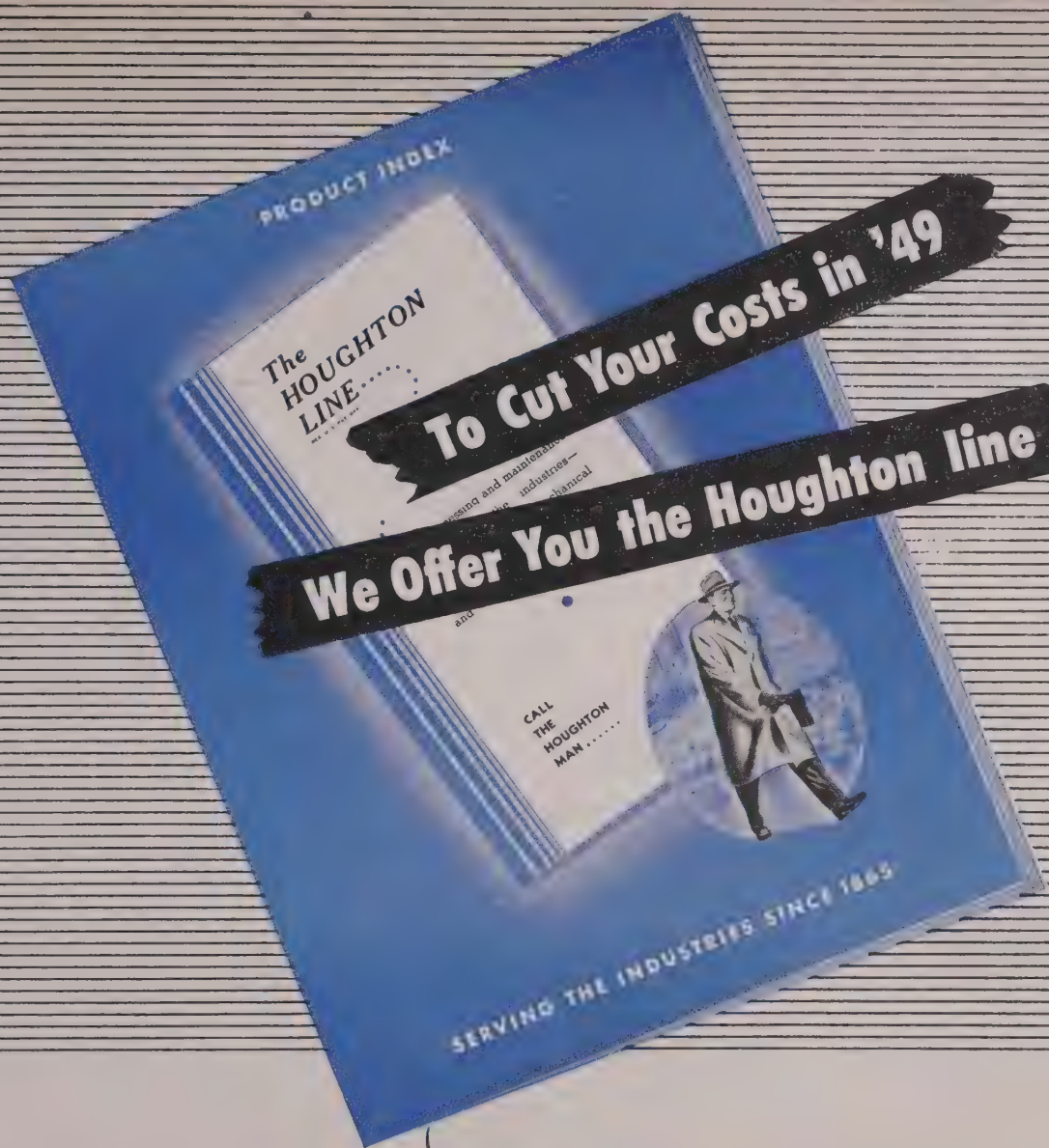
The plant manufactures power switchboards, control apparatus, panelboards, and fabricates Micarta plastic bearings and pulleys. It repairs motors, generators and other heavy electrical equipment for industry and railroads throughout northern New Jersey and the New York metropolitan area. A 61,200 sq ft warehouse serves as a distribution point for the company's other eastern seaboard warehouses.

Steel Plumbing Group Joins Porcelain Enamel Institute

Washington

• • • **Dissolution of the** Formed Metal Plumbing Ware Assn. was completed simultaneously with the mass transfer of the association's former members to a special division of the Porcelain Enamel Institute. The new PEI division, consisting of representatives of practically the entire steel plumbing ware industry, was incorporated during a recent meeting as the Steel Plumbing Fixture Div. of the Porcelain Enamel Institute.

According to the new PEI Steel Plumbing Fixture Div., the previous organization had been an informal association of industry members which was unchartered, and, which functioned without officers or a home office.



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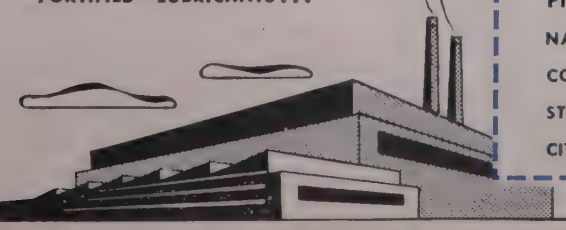
"FORTIFIED" LUBRICANTS . . .

It's a line of industrial processing and maintenance products, built on a foundation of 83 years' experience. You'll find it boiled down to six pages of product listings and descriptions, in the folder shown above. We suggest you write for a copy for your reference file, and that you discuss these good money-value materials with the Houghton Man when he calls on you. Ask him, too, about Houghton Service, so helpful to plant men.



Mail to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Please send me free copy of the Houghton Product Index.

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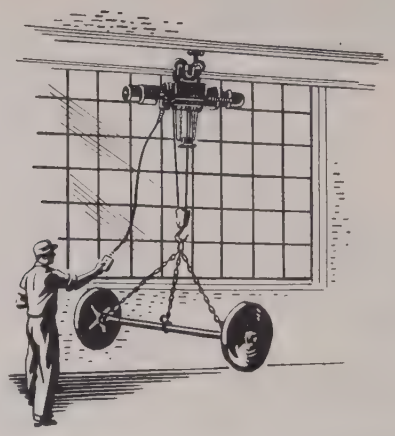
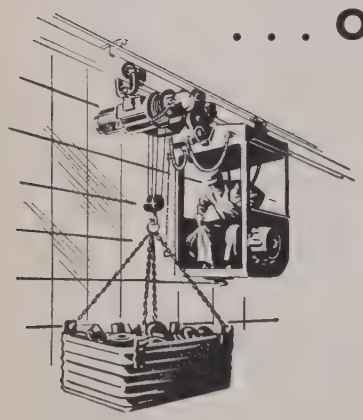
THEY LIFT THE SAME LOAD
BUT THEIR RUNNING COSTS DIFFER—



On the floor control, with the operator primarily occupied with other duties.

. . . OR



The operator in the cab, traveling loads at speeds up to 500 f.p.m. or more and occupying a better vantage point for spotting or stacking.

It's not always easy to forecast which type of service will best fill the bill.

Let the Shepard Niles specialist show you pertinent data on typical installations. He sells both types of hoist and overhead cranes as well, so he approaches your materials handling problem with an open, unprejudiced mind.

SHEPARD NILES
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Makes and sells all three lifting tools for airborne shop loads.

356 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

WAA Sells Ore Property To a New York Company

New York

• • • **The old iron** mining property located at Ringwood, N. J., has been sold to the Petroleum Export-Import Corp., New York, for $700,000 by the War Assets Administration. A. E. Lynch, president of the company, has said that it would spend about $425,000 additional for improvement and development.

The mine property, comprising nearly 900 acres, contains two known ore deposits, the Peters Mine, located on the northern end, and the Cannon Mine in the center of the property. These are deep mines and one has a sloping shaft required by the terrain. For that reason it has not been possible to put down test drillings from the surface. Learning of a statement to the effect that the reserves should exceed 8 million tons, those familiar with the mine have expressed some doubt about the estimated tonnage. The ore requires concentrating and sintering. Concentrates should run about 65 pct iron. They are similar to the concentrates from the Scrub Oaks mine of Alan Wood Steel Co. at Wharton, N. J., except for a higher phosphorus content.

During the war, Alan Wood was requested by the government to recondition the mine. They pumped out the mine to get it ready for operation. The government spent close to $4 million to get the mine in condition to operate, but the end of the war stopped reconditioning work.

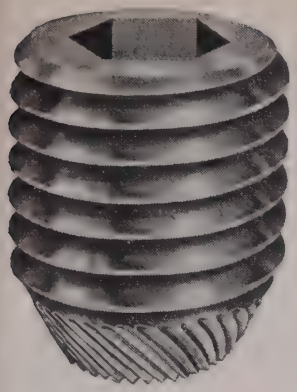
Reports on Tungsten Ore

Washington

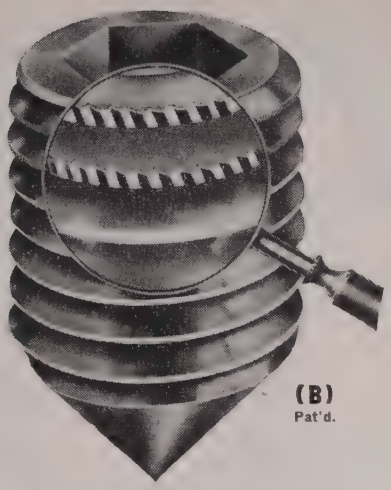
• • • **A report on** wartime development and operation of the Hamme tungsten district in North Carolina and Virginia is available for the asking from the Pittsburgh office of the Bureau of Mines (Report of Investigations 4380).

This district, involving areas in Vance County, N. C., and Mecklenburg County, Va., is considered by the Bureau as the only known important tungsten deposit in the east. A modern 200-ton ore mill was constructed for war production and this has since increased.

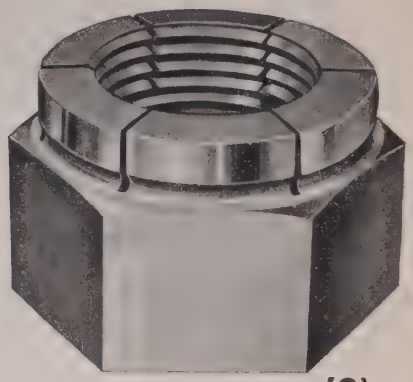
HONEST-TO-GOODNESS FASTENERS . . .



(A)
Pat'd. & Pats. Pending



(B)
Pat'd.



(C)
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Reg. U. S. Pat. Off.

SELF-LOCKING SOCKET SET SCREWS

AND

FLEXLOC

SELF-LOCKING ONE-PIECE NUTS

(A) The KNURLED cup point of this popular "Unbrako" Socket Set Screw makes it a *Self-Locker* . . . because the keen edges of the counter-clock-wise KNURLS prevent creep, regardless of the most chattering vibration. An honest-to-goodness fastener, if ever there was one . . . it positively *won't shake loose!*

(B) The KNURLING of this "Unbrako" Socket Set Screw—as shown—"swages" the threads, so that it becomes a most excellent Self-Locker . . . positively *won't shake loose!* For use where the Knurled Cup Point cannot be utilized because of a hardened steel shaft . . . or where the other 5 standard points do not lend themselves to knurling. Sizes available from #4 to 1½" diameter, in a full range of lengths.

(C) The one-piece, all-metal, full-thread, resilient "Flexloc" Lock Nut is becoming widely accepted, because it is processed to have an exceptionally uniform torque . . . and because it is a "stop," a "lock" and a "plain" nut *all in one.* Sizes from #6 to 2" diameter, in *regular* and *thin* types—in NC and NF thread series.

Write us for the name and address of your nearest "Unbrako" Industrial Distributor and for your copy of the "Unbrako" Catalog.

Knurling of Socket Screws originated with "Unbrako" in 1934.

Pat'd and Pats. Pend.

"UNBRAKO" SOCKET-HEAD STRIPPER BOLT WITH KNURLED HEAD

The *Knurled* head of this "Unbrako" Socket Head Stripper Bolt allows for fumble-proof grip—even if fingers and head are oily — thus, materially speeding production.

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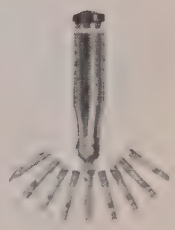
"Hallowell" Solid Steel Collars are functionally proportioned throughout, highly polished all over, and run true as a die. 3" bore and smaller are made from Solid Bar Stock and fitted with the famous "Unbrako" *Knurled* Cup Point Self-Locking Socket Set Screw. Available in sizes from 3/16" to 3". Immediate delivery.

"HALLOWELL" KEY KIT

You can't tighten or loosen socket screws without a hex socket wrench, so why not get our #25 or #50 "Hallowell" Hollow Handle Key Kit which contains most all hex socket bits.



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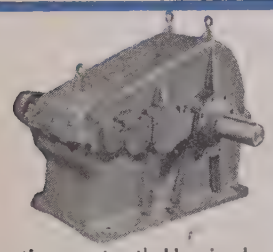
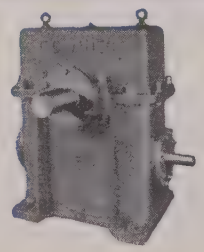
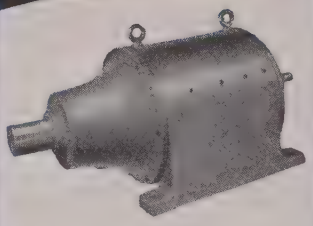


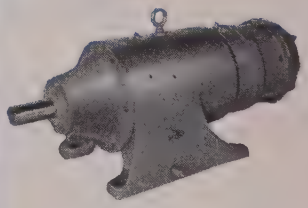
Continuous-tooth Herringbone
Single, Double, Triple Reduction



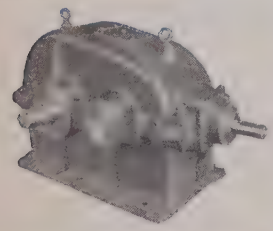
Type "H" Worm Gear



Straight Line Gear Reducer

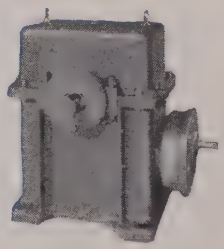


Motorized Reducers

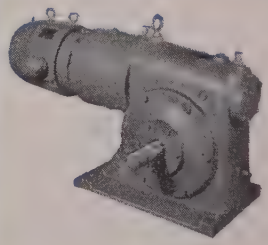


Spiral Bevel Herringbone

Double Worm Gear

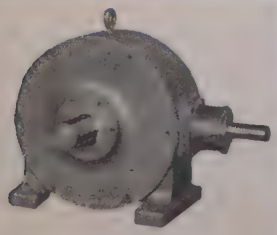


Helical Worm Gear



Motorized Worm Gear

Right Angle Gear Reducer



Spiral Bevel Gear

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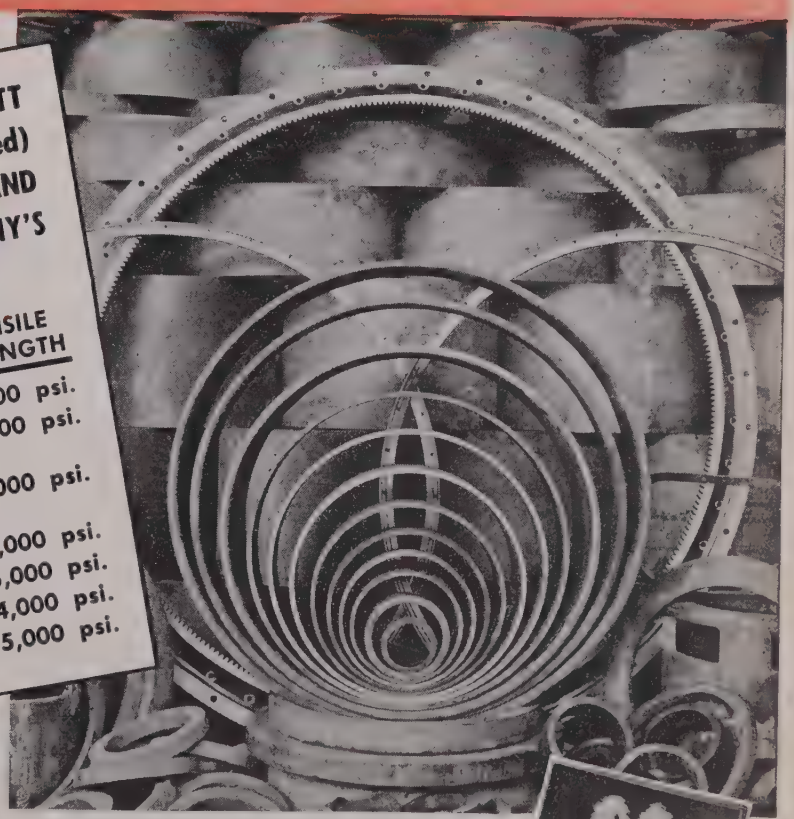
Stainless, Type No. 410	76,000 psi.
Stainless, Type No. 347	91,000 psi.
AISI-8630	115,000 psi.
Inconel-X	124,000 psi.
N-155	135,000 psi.



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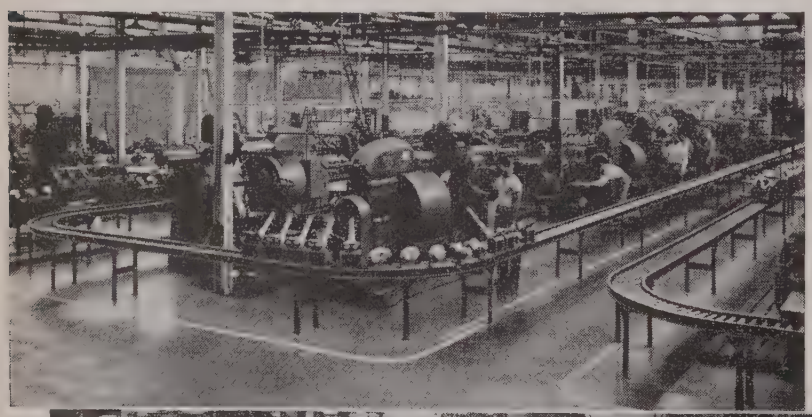

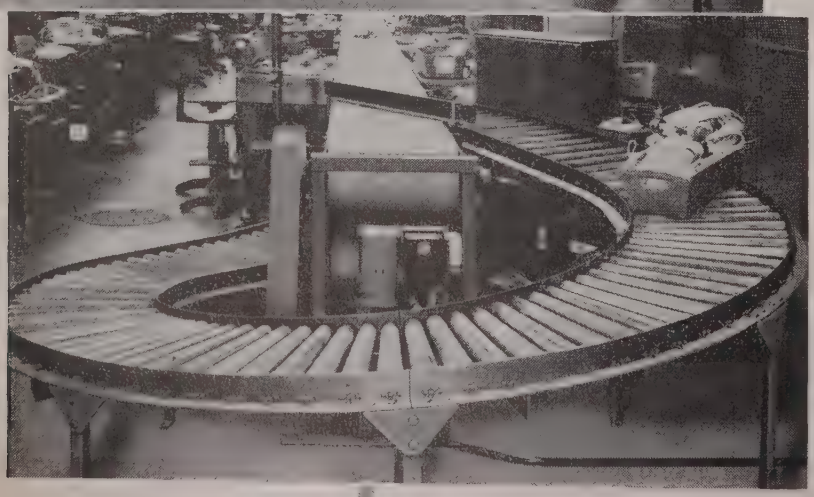

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Standard

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ECA Approves More Aid

Washington

• • • **First** authorization of Marshall Plan aid for third quarter delivery in 1949 was made last week when Economic Cooperation Administration approved purchase of $430,000 worth of metalworking machinery for Austria.

Other authorizations for purchase of United States industrial goods approved during the week ending Dec. 15, were relatively small and included $200,000 worth of hand tools for the Netherlands, $180,000 in agricultural machinery for Norway, $76,000 worth of tinplate for Belgium and Sweden, $373,000 worth of miscellaneous metals and their products, and $8.5 million worth of merchant marine equipment for France.

During the same period, ECA authorized Bizonal purchases of $10.5 million worth of railway and other transportation equipment from Czechoslovakia and $2.2 million worth of Hungarian manufacture.

New Officers Elected

Chicago

• • • **The Michigan Div.** of the Society of Industrial Packing and Materials Handling Engineers, elected the following officers for the 1949 term: H. G. Diefendorf, president, material handling consultant; Richard A. Brand, vice president, Ted Fordon & Assoc.; Edwin F. Avery, vice president, Fruehauf Trailer Co.; Randall E. Crabb, treasurer, Acme Steel Co.; E. H. Van Wagnon, secretary, General Motors Overseas Operations; William McKee Dunn, program chairman, Kimberly Clark Corp.; John N. Bode, membership chairman, Sherman Paper Products Co.; and V. Lee Edwards, publicity chairman, The Chas. A. Strelinger Co.

Export Licenses Extended

Washington

• • • **Validity periods** of all export licenses for West Coast port shipments which otherwise expire between Dec. 31 and Feb. 14, are automatically extended through Feb. 15, 1949, the Commerce Dept. announces.

Action was taken because of port congestion resulting from the longshoreman strike. Three previous license extensions had been made, running through Dec. 31.

Sunbeam STEWART

THE BEST INDUSTRIAL FURNACES MADE

Regardless of whether you heat treat in small quantities or continuous production, Sunbeam Stewart engineers are well qualified to recommend the correct furnaces to meet your requirements.

As a division of Sunbeam Corporation we have the opportunity of working with our furnaces in the production of Sunbeam appliances, lawn sprinklers, sheep shears, animal clippers, etc. In manufacturing our own products we must contend with practically every heat treating problem faced by industry—a position unique in the furnace manufacturing field.

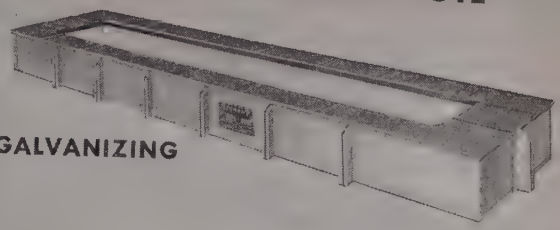
This experience with our own furnaces in both small or large volume production enables us to render a service to you far beyond other manufacturers. That is one reason why Sunbeam Stewart Furnace installations have been so successful. They are based not only on furnace engineering ability, but on practical experience under actual operating conditions. We have learned through actual experience the factors that give longest furnace life . . . greatest production . . . best quality . . . and lowest operating cost.

Our highly trained technical staff of furnace engineers, who for over 50 years have built furnaces for the leading companies throughout the United States and abroad, are qualified to recommend the correct type of furnace to meet your requirements.

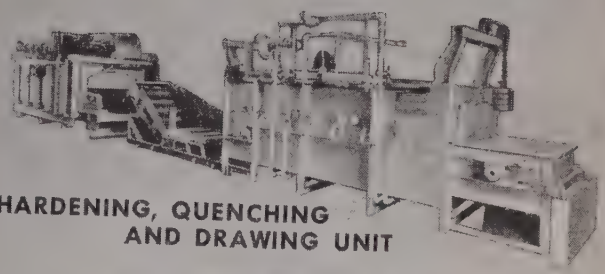
A letter, wire or 'phone call will promptly bring you information and details on Sunbeam Stewart Furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a Sunbeam Stewart engineer will be glad to call and discuss your heat treating problem.

THERE IS A SUNBEAM STEWART INDUSTRIAL FURNACE FOR EVERY NEED

GAS · ELECTRIC · OIL



GALVANIZING



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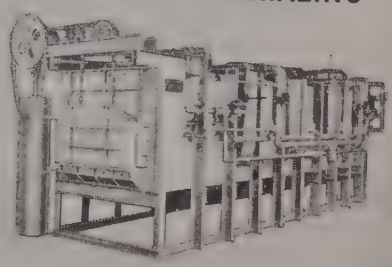
FURNACE BRAZING



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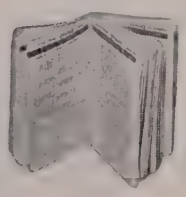
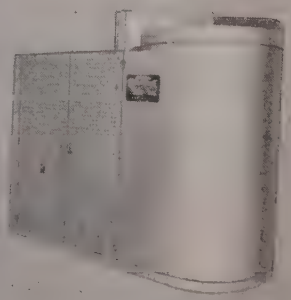


NAME_____ TITLE_____

COMPANY_____

ADDRESS_____ CITY_____ STATE_____



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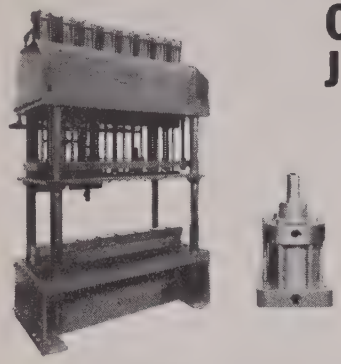
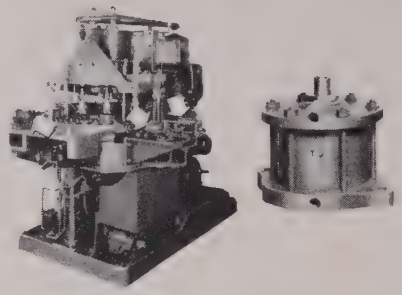
T-J SAVES LABOR

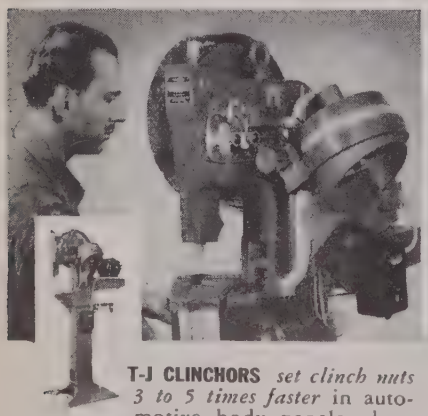
ON THOUSANDS OF JOBS FOR INDUSTRY!



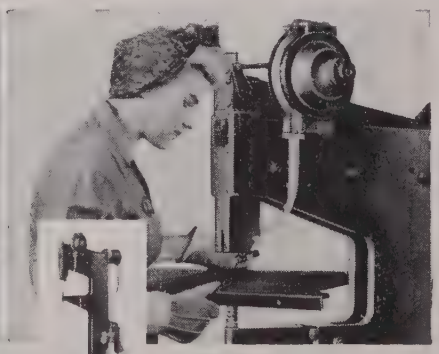
T-J HYDRAULIC CYLINDERS *simplify machines* . . . save time and labor on jobs where pushing, pulling or lifting is needed . . . 100 lb. or 50,000 lb. Shown here—a shell loading press with T-J Cylinders.



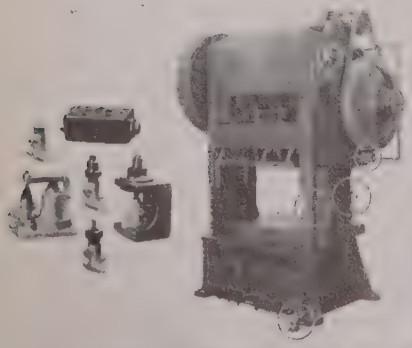
T-J AIR CYLINDERS *do push-pull-lift jobs* . . . 100 lb. to 12,000 lb. . . . wide range of styles, sizes and strokes. Shown here—Automatic Drilling and Threading Machine with T-J Cylinders.



T-J CLINCHORS *set clinch nuts 3 to 5 times faster* in automotive body panels, door locks, other products. Fully automatic —controlled by foot pedal.



T-J RIVITORS *with automatic feeding and setting . . . air powered* for aluminum alloy rivets 1/16" to 1/4" dia., up to 3/4" long. *Electrically powered* for solid steel rivets 1/16" to 1/4" dia., up to 7/8" long.



T-J CUTTERS *for more work between grinds* in tough die steels . . . accurate . . . sturdy . . . less breakage. All standard types and sizes.

T-J AIR CONTROLS *provide accurate, automatic control* for presses, brakes, other machines and equipment . . . designed for air cylinders in semi-automatic or automatic cycles.

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Utility Companies Are Eligible to Get Awards

New York

• • • **Electric utility** companies which conducted local educational activities on electrical living during 1948 will be eligible for the George A. Hughes awards to be presented next April, James J. Nance, president, Hotpoint, Inc., announced recently. The annual cash awards, as well as trophies and plaques, are offered by Hotpoint under the sponsorship of Edison Electric Institute.

In addition to educational activities on three levels of kitchen appliance merchandising to receive recognition in previous years, the Hughes award for 1948 has been expanded to include electric water heating activities. Class one awards consist of a trophy, plaque and a cash award to the two most outstanding utility promotions centering around electric kitchens.

Class two awards of trophy, plaque and cash award will be made to the two utility companies adjudged to have done the best educational job on domestic electric ranges. In the third classification, a trophy, plaque and cash awards will be divided between the two utility companies considered the leaders in electric water heater promotion.

The class four award of trophy, plaque and $400 in cash will be made to the two utility companies doing the most outstanding educational work in the field of commercial electric cooking. A total of eight awards and $2400 in cash will be distributed by the awards committee of the Edison Electric Institute in the four classifications.

Basis of awards of the contest, which closes Feb. 1, 1949, will be in local newspaper advertising, displays, educational work with home economists in schools and colleges, market cultivation among consumer builders, contractors and architects, sales training programs, and dealer cooperative activities.

Top honors in the 1947 Hughes award were shared by the Philadelphia Electric Co., the Georgia Power Co. and the Indiana Service Corp.

Presentation of the 1948 awards will be made at the 1949 annual Edison Electric Institute sales conference to be held in Chicago next April.

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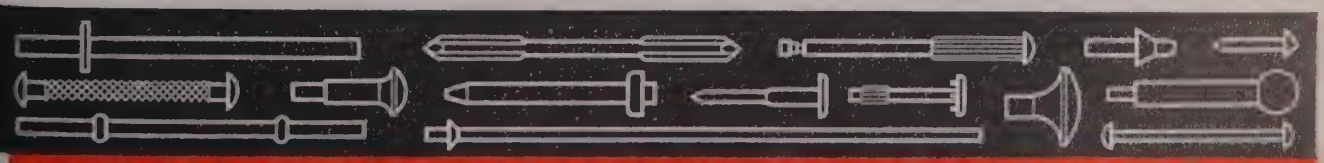

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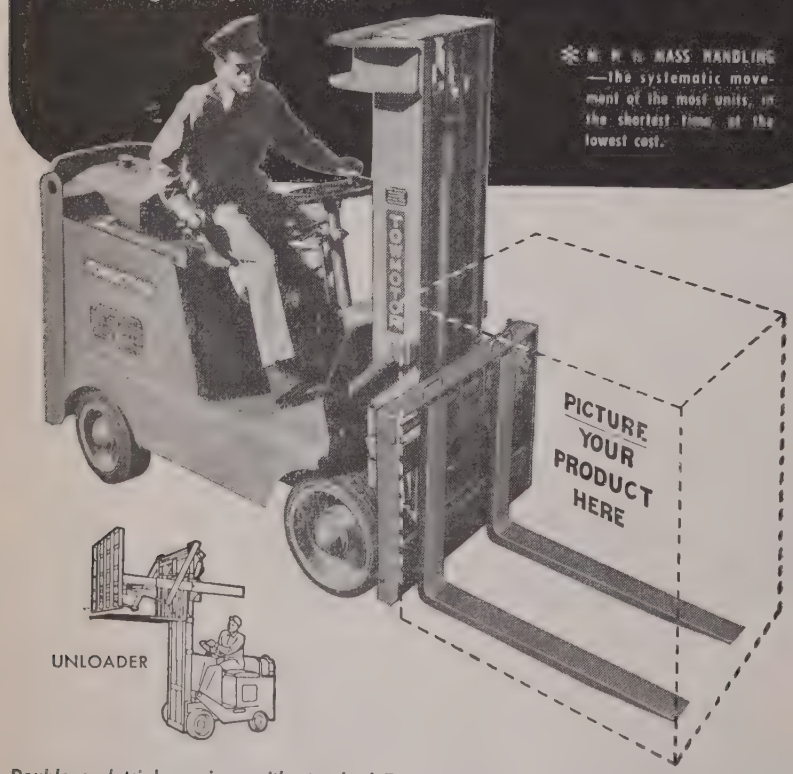
*M. H. is MASS HANDLING—the systematic movement of the most units, in the shortest time, at the lowest cost.



Double and triple savings with standard Towmotor Accessories. However, if a standard Towmotor unit does not solve your handling problem, Towmotor engineers welcome the opportunity to design special equipment to meet your specific needs. Details are available without obligation.

See our exhibit,
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Plans for Material Handling Show Now Nearing Completion

Philadelphia

• • • **A broad conference** on the problems of materials handling in the various industries of the country will be held at Convention Hall here Jan. 10-14. The conference will be under the sponsorship of the materials handling and management divisions of the American Society of Mechanical Engineers. General chairman of the conference and president of ASME materials handling division is Curtis H. Barker, Jr.

The conference will be held concurrently with the materials handling show, where 225 exhibitors will display the latest models of hand trucks, lift trucks, conveyors, hoists, monorails, portable elevators, stacking units, cranes, tractors, trailers, fork trucks, skids and pallets and their respective accessories. The show is sponsored jointly by ASME division and the Material Handling Institute. According to Mr. Barker it will cover more than 100,000 sq ft of net exhibit space.

Featuring the conference will be a story of the Army's gigantic materials handling problem in connection with the Berlin air lift, an operation unparalleled in handling history.

The program follows:

"Prologue Session," Monday, Jan. 10, afternoon.

Chairman Bernard Lester, sales consultant, N. Y., N. Y., program committee chairman, ASME materials handling division. "Message of Welcome," Mr. Barker. "Outlook for the Industry," Dr. Charles F. Roos, president, Econometric Institute, N. Y. "Opportunities for Sales Engineering," Ezra W. Clark, materials handling consultant, Battle Creek, Mich. "The User Talks to the Sales Engineer." T. O. English, assistant general purchasing agent, Aluminum Co. of America, Pittsburgh.

"Opportunities for Management," Tuesday, Jan. 11, morning.

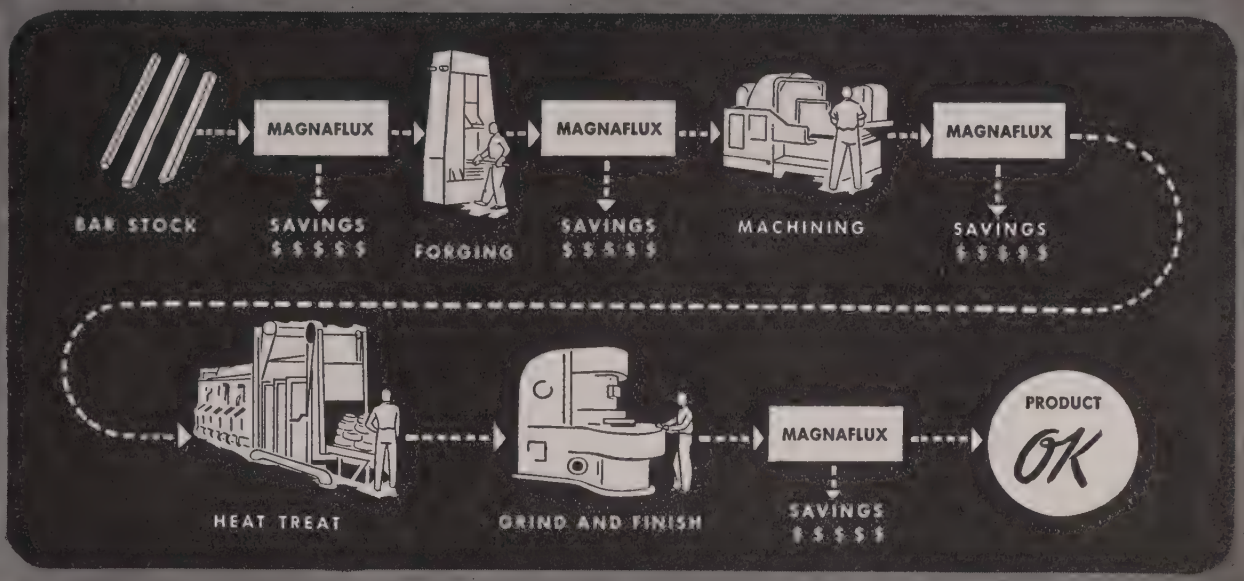
Chairman: Mr. Barker. "The Importance of Materials Handling," keynote address by Mr. Barker. "The Economies of Materials Handling," Stevens H. Hammond, president, Whiting Corp., Harvey, Ill. "The Materials Handling Engineer, his qualifications, functions and relation to management," T. L. Carter, materials handling engineer, American Cyanamid Co., N. Y.

"Improvements in Methods," Tuesday, Jan. 11, afternoon.

Chairman: H. B. Maynard, president, Methods Engineering Council, Pittsburgh, and member, executive committee, ASME management division. "Modern Methods Engineering and Materials Handling," by the chairman. "Work Simplification," Allan H. Mogensen, N. Y. "Opportunities for Distribution Economies—Industry's Recommendations to Common Carriers." A symposium. For industry: Neil Loney, industrial consultant, Detroit. For the railroads: Fred Carpi, vice-president, traffic, Pennsylvania R. R., Philadelphia. For the Highway Carriers: W. F. White, engineer, Great Southern Trucking Co.,

How MAGNAFLUX* Production Line Inspection

CAN CUT YOUR MANUFACTURING COSTS



Defective parts are rejected *before* additional money is spent in finishing them with inspection by Magnaflux on the production line and trouble is found and corrected when it occurs—not later. For many plants this method of inspection is already saving thousands of dollars in manufacturing costs each year.

For example, by inspection with Magnaflux a gear manufacturer is able to reject defective pieces of material in bar form, or after forging. He saves the cost of machining, heat treating, grinding and finishing many pieces which would later be rejected at final inspection. In rejecting still more pieces after machining, with a third Magnaflux inspection, he saves the cost of heat treating and grinding.

Add up the total savings made by cutting out subsequent steps for all rejects. You'll see that *total* cost of inspection is *much less* than cost of carrying all defective parts to finish stage. Here is a table showing these savings:

Table Based on Processing 1000 Parts	Processing Cost Investment	Rejects Due to Operation	Savings in Cost to Finish	Inspection Costs all Parts
Bar	$ 1.00	10	$190.00	$ 70.00
Forging	3.00	10	170.00	69.30
Machined Gear	11.00	10	90.00	68.60
Ground and Finished Gear	20.00	20		67.20
		50	$450.00	$275.10

Inspection with Magnaflux not only pays for itself, but gives a net savings of $174.90 per 1,000 gears. This example is based on 100% inspection after each operation except heat treating. However, sampling methods often can be used for similar in-process inspection to cut manufacturing costs.

Magnaflux, and other Magnaflux Corporation non-destructive testing methods, make cracks and other defects readily visible for inspection of every part at production line speed. Write today for full information on how Magnaflux can help you raise product quality and cut production costs.

**Magnaflux, Reg. U. S. Pat. Off., a trade mark of Magnaflux Corporation applied to its equipment and materials for magnetic particle inspection.*

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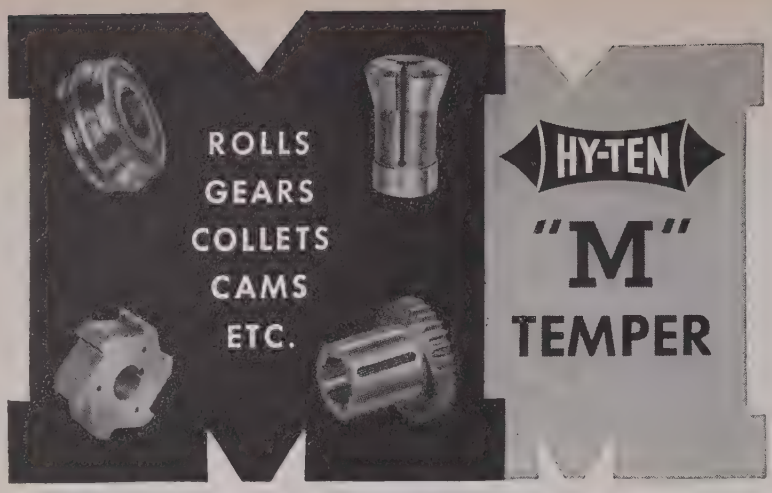

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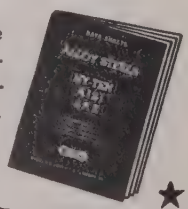
Write today for your FREE COPY of the Wheelock, Lovejoy Data Book. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.



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HY-TEN and AISI

Jacksonville, Fla. For the National Point of View: J. W. Milliken, associate editor, Railway Age, New York.

"Case Studies," Wednesday, Jan. 12, morning.

Chairman: J. B. McGinn, division engineer, American Viscose Corp., Philadelphia, and president, Materials Handling Society of Philadelphia. "Efficient Coordination of Materials Handling Equipment in a Manufacturing Plant," C. M. Harris, production manager, Electrolux Corp., Old Greenwich, Conn.; "Application of Methods Engineering and Equipment Design," Donald E. Farr, engineering supervisor, Methods Engineering Council, Pittsburgh. "Ups and Downs of Handling in Multi-Story Warehouses," D. O. Haynes, vice-president, Merchants Refrigerating Co., N. Y.

"Panel Discussion," Wednesday, Jan. 12, afternoon.

Chairman: Harry E. Blank, managing editor, Modern Industry, N. Y. "Industrial Relations" (speaker to be announced). "Cost Control," Emil Gibian, chief industrial engineer, Thompson Products, Inc., Cleveland. "Lighting," Arthur A. Brainerd, illuminating engineer, market studies and applications divisions, Philadelphia Electric Co., Philadelphia. "Building Construction" (speaker to be announced). "Safety," D. M. Rush, manager, central planning department, Ansco division, General Aniline and Film Corp., Binghamton, N. Y.

"Advances in Technique," Thursday, Jan. 13, morning.

Chairman: Jervis B. Webb, president, Jervis B. Webb Co., Detroit. "Automatic Pallet Loading," M. Landon, engineering department, Sun Oil Co., Philadelphia. "Equipment, Layout, Operation Processing," W. J. Dernberger, superintendent, materials handling engineering, Ford Motor Co., Dearborn, Mich. "Developments in Bulk Handling," E. A. Wendell, sales manager, Link-Belt Co., Chicago.

"Equipment Symposium," Thursday, Jan. 13, afternoon.

Chairman: J. D. Sheahan, secretary-treasurer, Drake, Startzman, Sheahan, Barclay, Inc., N. Y. "Developments in Conveyor Design and Application." Association participating: Conveyor Equipment Manufacturers Association, Washington, D. C.; R. C. Sollenberger, Executive Secretary of the Assn. "Developments in Crane, Hoist, and Elevator Design and Application." Association participating: Overhead Traveling Crane Institute, New York; A. R. Walkeley, general sales manager, Shaw-Box Crane and Hoist Division, Manning, Maxwell & Moore, Inc., Muskegon, F. M. Blum, sales manager, Overhead Traveling Division, Harnischfeger Corp., Milwaukee. "Developments in Industrial Truck Design and Application." Association participating: Electric Industrial Association, Long Island City, N. Y., together with leading manufacturers of gas trucks; Robert Pratt, chief industrial engineer, General Foods Corp., New York; Lee C. Daniels, chief engineer, Towmotor Corp., Cleveland; J. C. Erickson, chief engineer, The Elwell-Parker Electric Co., Cleveland. "Developments in Marking and Stenciling," H. W. Hempel, vice-president, Marsh Stencil Machine Co., Belleville.

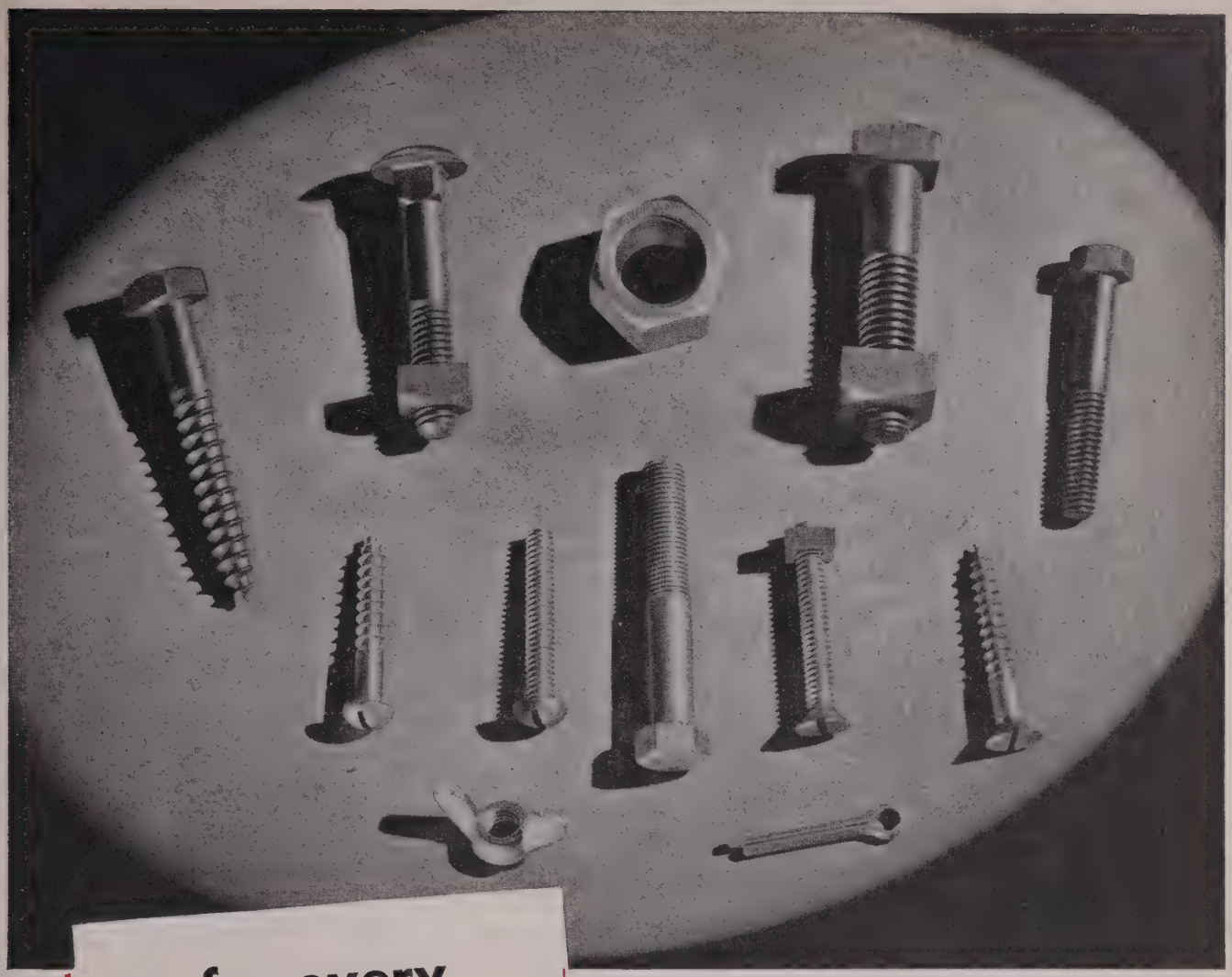
"Materials Handling of Tomorrow," Friday, Jan. 14, morning.

Chairman: John B. Thurston, Wallace Clark and Co., New York. "The Biggest Handling Job in the World," Col. James Glore, Transportation Corps Board, New York Port of Embarkation, Brooklyn, N. Y. "Tomorrow in Air Handling," Parkman Sayward, general sales manager, Slick Airways, Inc., San Antonio. "Lessons from the Berlin Air Lift" (speaker to be provided by the U. S. Air Force).

Ask ECA Aid for Science

New York

• • • **European recovery** can be greatly accelerated by providing Marshall Plan aid for the restoration of devastated scientific laboratories, the American Chemical Society declared in an appeal to Paul G. Hoffman, head of the Economic Cooperation Administration, to allot funds for this purpose.



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Super Service Station Used for Locomotives

Chicago

• • • **When the Chicago & North** Western Railroad opened its super service station for diesel locomotives in its Chicago shops, it overcame one of the disadvantages of using diesel locomotives. Many railroads, although using diesel locomotives for some time, have not had adequate maintenance repair and service shops. In many cases, diesel locomotives are being serviced in a corner of the old maintenance and repair shops built for steam locomotives.

North Western, however, went all out with their new facilities. Their new service and repair shop located at Keeler & Kinzie Avenues in Chicago, cost $1,800,000 to build. The building is 142 ft by 407 ft with a cubical content of 1,000,928 cu ft. It can handle simultaneously 16 freight diesel locomotive units or 12 passenger diesel units. All types of diesel locomotive repair, in addition to servicing, can be handled in this shop.

The central bay is serviced by a 30-ton traveling crane with a 75 ft span. The drop table, automatically operated by push button control, permits workers to change wheels or trucks on locomotives in about 1 hr without moving the diesel engine itself. Special rooms are provided for dismantling and reassembling diesel motors, handling storage batteries, painting and reconditioning parts, and all similar operations.

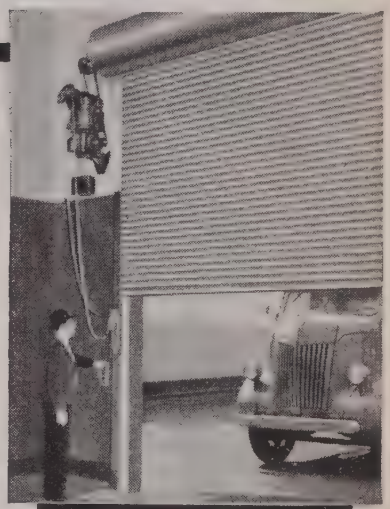
One of the big arguments between diesel and steam locomotives men has been maintenance cost per mile. Railroad men have had many arguments on the maintenance cost of diesel locomotives, some of which were beclouded by the fact that steam and diesel maintenance facilities are carried on together throughout the system of any particular railroad. The North Western installation permits them to calculate precisely what their maintenance cost on the now popular type of tractive power will be.

Tennessee Gas Planning Huge Expansion Project

Washington

• • • **Tennessee Gas Transmission** Co. of Houston has been authorized by the Federal Power Commission

Reasons why it pays to insist on KINNEAR ROLLING DOORS



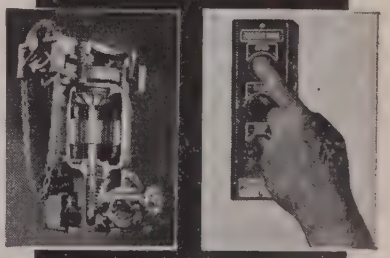
KINNEAR *Originated* the interlocking steel-slat door!

KINNEAR ROLLING DOORS feature the famous interlocking steel-slat curtain that brings highest efficiency to service openings of every type. With smooth, easy coiling upward action, they glide out of the way overhead, safe from damage. Doorways remain clear—from jamb to jamb *and* from floor to lintel—until the doors are closed again.

All wall and floor areas *surrounding* the opening are fully usable at all times. Materials or merchandise can be stored within an inch or two of the door curtain, on either *or both* sides, without impeding its action. The tough, flexible, all-steel construction of Kinnear Rolling Doors gives them longer service life, cuts maintenance costs to rock-bottom, and assures extra resistance to weather, wear, fire and intrusion.

For added ease and speed of operation, Kinnear Steel Rolling Doors can be equipped with Kinnear Motor Operators. Pushbutton controls may be placed at the door jamb, as well as at one or more remote points. Several doors may be operated from a single control panel if desired.

Kinnear Rolling Doors can be tailored to fit any opening, in old or new construction. Manual, chain, or crank operation is available where the advantages of motorized doors are not required. Write for the Kinnear Catalog, or for recommendations on your particular door needs.



The husky Kinnear Motor Operator, controlled by pushbutton, permits you to raise, lower or stop the door from any number of convenient points.

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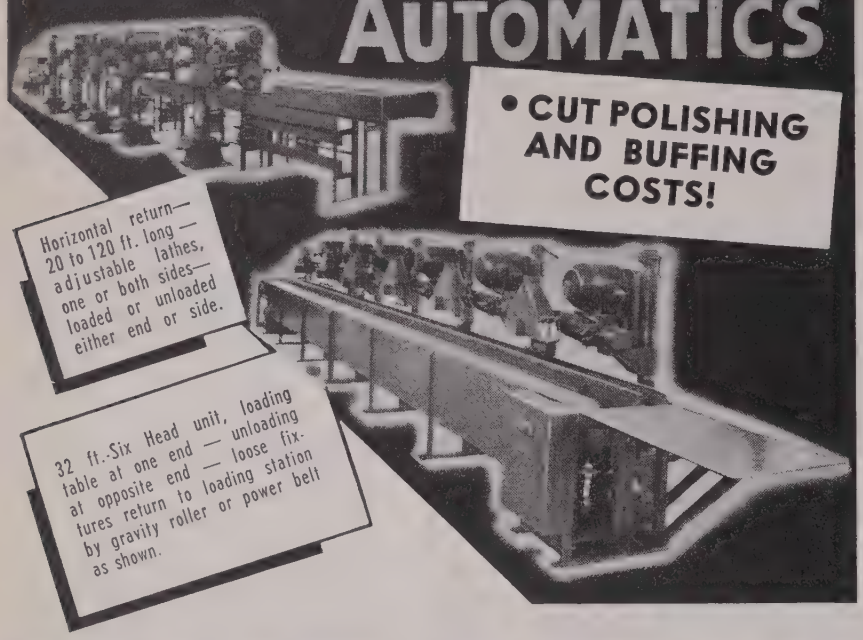

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Extra yard profits from low cost handling with

ROUSTABOUT CRANES

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● You've got a crane with hook or magnet anywhere you want it around your yard exactly when you want it—when a Roustabout is on the job. Fast, powerful, this mobile load-hustler gives you low cost materials handling outdoors all around your plant to match your indoor efficiency. It keeps things organized, on the move, prevents costly delays—no waiting for crews from other jobs. Built for years of overwork—ball-bearing boom turntable, all gears in oil. Capacities to 7½ tons—it's the answer to your yard problem. For complete facts . . . write to Dept. D-1

Photo courtesy of Industrial Power Division, International Harvester Company

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HUGHES-KEENAN CORPORATION
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to go ahead with construction of additional facilities which will deliver 111 million cu ft of gas to the Manufacturers Light & Power Co.

Involved are 516 miles of main line loops, along the existing system from the Southeast to the Appalachian area, and 85 miles of lateral lines.

This is but a part of the overall expansion planned by Tennessee Gas. In addition, the company has planned a 238-mile line from Kentucky into northern Ohio, a 395-mile main from Kentucky to Buffalo, and 909 miles of loop lines along the existing main line in Texas, Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and West Virginia.

Depending on thicknesses, upwards of 500,000 tons of pipe would be required for the overall project, if approved. Holding that the company "has not shown that it possesses a supply of gas reasonably adequate" to meet both customer and probable new demands, further hearings will be held on the remaining phases of the program.

Establish New Service To Exhibit Inventions

Chicago

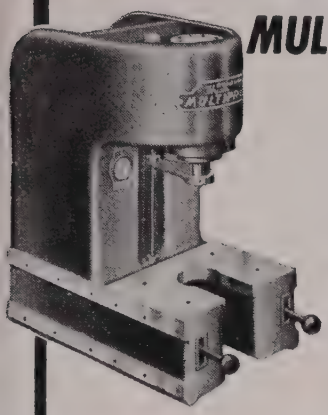
• • • **A new service,** designed to bring together inventors and manufacturers, has been established by American Inventors Exhibit, 184 W. Washington St., Chicago, Ill.

A. I. E. is opening a permanent exhibition hall in Chicago's Loop, where businessmen and manufacturers may come to find new ideas and inventions to use in their businesses. New inventions in virtually every field of endeavor will be exhibited by their owners, many of which will find practical application in industry. Among the many fields expected to be represented are aviation, radio, television, telephony, building construction, mechanized farming and railroading.

Anyone may exhibit any type of invention, patent, idea or plan on a permanent basis. Manufacturers are invited to see the wares of inventors from all over the country in what will be the first permanent exhibit of its kind. Among the inventions to be shown are a jet-propelled train reputed by its inventor to travel at 200 mph and an automatic brake for baby carriages.

STEP UP PRODUCTION ...INCREASE PROFITS

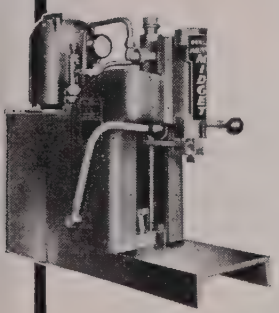
with DENISON MULTIPRESS and HydrOILic EQUIPMENT!



In hundreds of plants throughout the world manufacturers have turned to DENISON equipment for greater production—greater job profit! This outstanding, hydraulic oil-smooth equipment is establishing production records for others—*and can do it for you!*

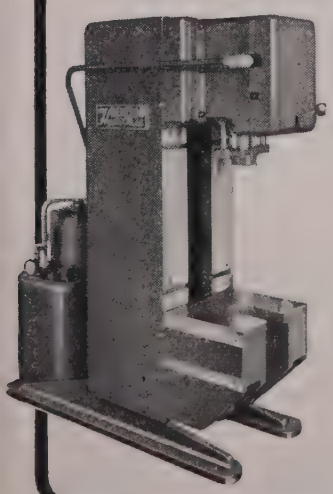
SLASH OPERATING COSTS WITH THE 4, 6 and 8-ton MULTIPRESS

The reason for the phenomenal achievement of MULTIPRESS, in those compact, bench size units, is found in its many hydraulically oil-smooth features. Its "feather-touch" dual control levers minimize accidents and make for ease of operation, while presetting controls of ram pressure and speed enables the operator to adapt the press to any job needs. These features, and many others, make MULTIPRESS a faster, more accurate production tool with a wide variety of applications. The 4 and 6-ton MULTIPRESS has a 6″ stroke, 12″ daylight, 6″ throat, and ram down speed 500 ipm, up speed 300 ipm; the 8-ton has a 12″ stroke, 18″ daylight, 8½″ throat, ram down speed 500 ipm, up speed 300 ipm.



IT'S THE MIDGET...THE NEW, LOW PRICED MULTIPRESS FOR SMALL PARTS PRODUCTION!

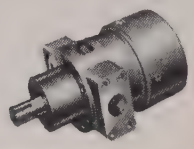
The production-boosting, cost-cutting features of the MULTIPRESS are now available in 2000 lb. capacity press! Self-contained, individually powered and light in weight, the MIDGET can be moved anywhere in the shop. And because of its great versatility of control and ease of tooling, the MIDGET can be rapidly switched from one job to another. The MIDGET has a 6″ stroke, 10″ standard or 15-⅜″ optional daylight, 4-⅝″ throat depth, ram down speed 400 ipm, ram up speed 600 ipm, 10″ x 10″ base plate tooling area, 13″ x 30″ x 29-¾″ dimensions, 270 lbs. weight.



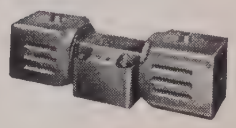
THE MULTI-UNIT IS A "TAILOR-MADE" ASSEMBLY WITH MULTIPRESS FEATURES

The MULTI-UNIT is composed of separate, compact units that combine readily in many arrangements—actually several complete presses in one! It possesses all the MULTIPRESS controls but affords greater latitude for the processing of larger parts by having up to a 24″ daylight. MULTI-UNITS include pumping unit, power head, standard frame and bolster. These components, assembled, provide a "tailor-made" assembly. In two sizes of 4 and 6-tons, the specifications are, for each: ram down speed 180 ipm; up speed 270 ipm. Daylight opening of 10″ to 24″ can be provided. Ram pressures for the 4-ton model may be set anywhere between 1,600 and 8,000 lbs. and for the 6-ton model, between 1,600 and 12,000 lbs.

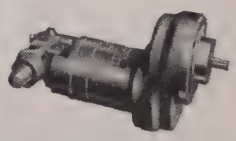
PUMPING UNITS—The Denison Pumping Units are oil-hydraulic power plants in self-contained form. They are available in two sizes, providing regulative pressures to 2000 psi, volumes from 1.5 to 11 gpm.



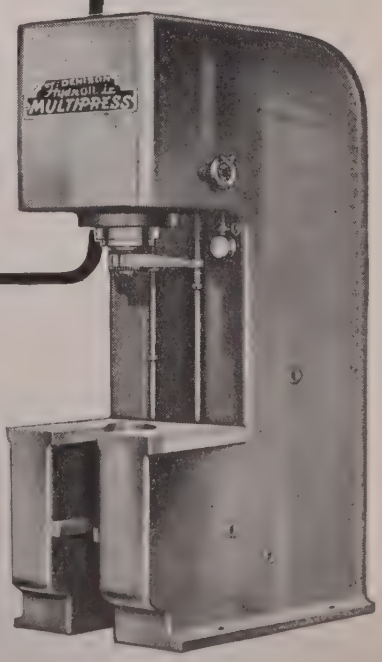
PUMPS—The three Denison 5000 psi pumps are of an axial piston constant displacement type, and deliver volumes of 6, 17 and 32 gpm respectively at 1200 rpm with volumetric efficiency of not less than 95%. Quiet operation, and compact design, make these pumps the last word in modern hydraulic power.



4-WAY VALVES—Hydraulically balanced 4-way valves for smooth, trouble-free operation in high pressure installations. Supplied in subplate of threaded body types for operation either hydraulically, mechanically, manually, or electrically.



FLUID MOTORS—Rotary power to 98 hp is now supplied in the Denison Fluid Motor line. Featuring constant or variable speed control . . . a variety of attaching gear head units . . . stepless speed variation with instant acceleration to maximum speeds.



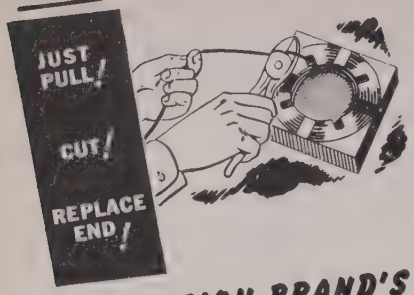
"THE BIG BROTHER" OF THE FAMILY—THE 25-ton MULTIPRESS!

The 25-ton capacity MULTIPRESS—the largest of the MULTIPRESS models—has all the basic features of the smaller units plus the added advantage of greater tonnage capacities. As with the smaller models, the 25-ton MULTIPRESS is ideally suited for automatic feeding of parts via a variety of hydraulically operated index feed tables. The 25-ton MULTIPRESS has a 15″ stroke, 24″ daylight, 12″ throat, 450 ipm down speed, 400 ipm up speed, and 210 ipm pressing speed.

The DENISON ENGINEERING CO.
1158 DUBLIN ROAD • COLUMBUS 16, OHIO

DENISON EQUIPMENT for APPLIED HydrOILics

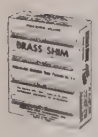
It's Easy to Use This MUSIC WIRE



See PRECISION BRAND'S New Dispenser Carton

Save time, speed work with this top quality Music Wire packed in the ingenious dispenser carton—exclusive with Precision Brand. Wire is pulled from center; tension holds coil in place. Wire is cold drawn with micrometer precision to meet exacting requirements. Immediate delivery on a complete range of thickness .004 to .180 diameter.

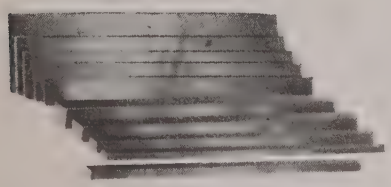
SHIM STOCK



Brass or Steel

Whether you choose the dispenser carton, the four-in-one assortment or flat stock packets, you can depend upon Precision Brand quality, accuracy, protective packaging and plain labeling to help do the job right.

GROUND FLAT STOCK



A complete line in either oil or water hardening types! Precision ground to within .001"—ready for scribing, shaping, tempering drawing. Each piece oiled, wax wrapped in protective envelope, marked with size and heat treatment.

CONSULT YOUR JOBBER

PRECISION STEEL WAREHOUSE, INC.
MANUFACTURING DIVISION
4409 WEST KINZIE ST., CHICAGO 24, ILL.

(CONTINUED FROM PAGE 227)

Birmingham Area
(Jefferson County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	490	4
33	Primary Metals	28,755	26
34	Fabricated Metal Products	5,568	29
35	Machinery (Except Electrical)	3,100	7
36	Electrical Machinery & Equipment	516	4
37	Transportation Equipment	1,614	4
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
	Birmingham Area Total	**40,043**	**74**

California

Los Angeles Area
(Los Angeles County)

19	Ordnance & Accessories	574	1
25	Furniture & Fixtures, Metal	1,669	22
33	Primary Metals	11,519	78
34	Fabricated Metal Products	32,400	227
35	Machinery (Except Electrical)	23,044	204
36	Electrical Machinery & Equipment	7,178	53
37	Transportation Equipment	72,813	72
38	Instruments & Photographic Equipment	4,642	24
39	Misc. Mfg. Industries (Metal)	2,160	22
	Los Angeles Area Total	**155,999**	**703**

San Diego Area
(San Diego County)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	..	..
34	Fabricated Metal Products	558	3
35	Machinery (Except Electrical)	502	4
36	Electrical Machinery & Equipment	150	1
37	Transportation Equipment	9,072	6
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	25	1
	San Diego Area Total	**10,307**	**15**

San Francisco-Oakland Area
(Alameda, Contra Costa, Marin, San Francisco, San Joaquin, San Mateo, Santa Clara Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	60	1
25	Furniture & Fixtures, Metal	1,198	2
33	Primary Metals	9,724	38
34	Fabricated Metal Products	14,269	97
35	Machinery (Except Electrical)	15,324	89
36	Electrical Machinery & Equipment	2,989	27
37	Transportation Equipment	39,780	33
38	Instruments & Photographic Equipment	460	4
39	Misc. Mfg. Industries (Metal)	337	5
	Area Total	**84,141**	**296**

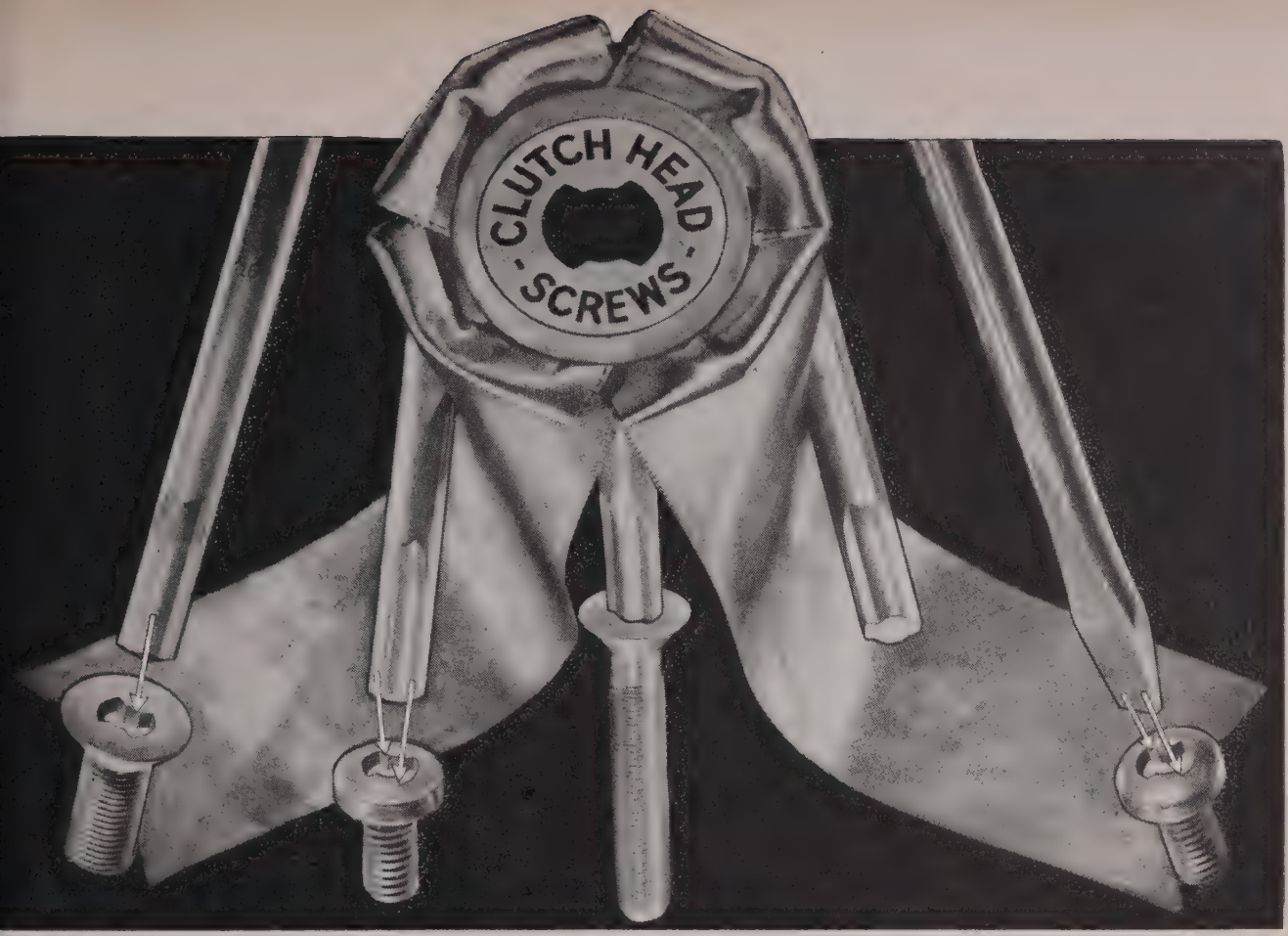
Connecticut

Bridgeport-New Haven-Waterbury Area
(Fairfield, New Haven Counties)

19	Ordnance & Accessories	9,260	5
25	Furniture & Fixtures, Metal	85	2
33	Primary Metals	26,691	56
34	Fabricated Metal Products	26,624	121
35	Machinery (Except Electrical)	24,254	98
36	Electrical Machinery & Equipment	14,662	35
37	Transportation Equipment	12,950	14
38	Instruments & Photographic Equipment	5,974	16
39	Misc. Mfg. Industries (Metal)	11,638	38
	Area Total	**132,138**	**385**

Hartford-New Britain Area
(Hartford County)

19	Ordnance & Accessories	1,550	2
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	2,658	13
34	Fabricated Metal Products	15,356	59
35	Machinery (Except Electrical)	40,133	65
36	Electrical Machinery & Equipment	11,018	16
37	Transportation Equipment	15,395	3
38	Instruments & Photographic Equipment	2,922	3
39	Misc. Mfg. Industries (Metal)	2,684	8
	Area Total	**91,716**	**169**



TYPE "A" ASSEMBLY BIT

COMMON SCREWDRIVER

Winner of Blue Ribbon Award in Power Driving

Engineering and Production Executives vote this award to CLUTCH HEAD Screws on the score of production increases ranging from 15% to 50% . . . plus the added savings accruing from the elimination of costly skid damage and of burred or chewed-up heads. On the basis of experience resulting from change-over from other types of recessed head screws, here is how these users score CLUTCH HEAD supremacy:

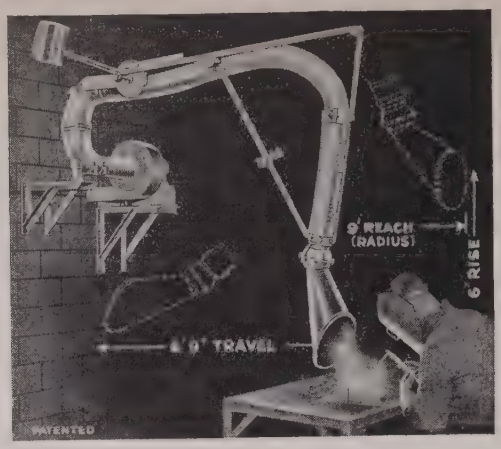
1. High visibility of the clutch recess inspires operator confidence for unhesitating faster driving, while dead-center entry with the Center Pivot Column prevents driver canting. Straight driving is automatic . . . hence no burred or chewed-up heads.
2. Absence of "ride-out," due to CLUTCH HEAD'S non-tapered driving engagement, checks out hazard of driver skidding. Freedom from end pressure makes driving effortless, safer and smoother for a stepped up tempo.
3. The Lock-On to check out fumble spots . . . screw and bit locking as a unit to permit one-handed reaching and driving from any angle.
4. The unequalled durability of the Type "A" Bit with a record of driving 214,000 screws non-stop . . . plus the economy of its repeatable reconditioning in a simple 60-second operation.
5. The importance of CLUTCH HEAD'S basic design for common screwdriver operation . . . to simplify adjustments and cure field service "headaches."

Make your own test of these exclusive CLUTCH HEAD features. Ask us to mail you screw assortment, sample Type "A" Bit and illustrated Brochure.

UNITED SCREW AND BOLT CORPORATION

CLEVELAND 2 — CHICAGO 8 — NEW YORK 7

RUEMELIN
Fume Collector
Removes Welding Fumes at the Source . . .



Why continue to let your employees inhale welding fumes? You can solve the problem quickly and efficiently by installing a Ruemelin Fume Collector. It produces a powerful suction that draws out noxious gases, smoke and heat at the source. Guards employee health, resulting in less welder fatigue, therefore, greater plant output. Clears shop air with minimum loss of building heat. Covers maximum welding area vertically, horizontally and by circle swing. Shipped assembled, easy to install. 9 ft. and 15 ft. sizes (radius of swing). Free engineering service for your fume collector installation. Write for Bulletin 37-C.

RUEMELIN MFG. COMPANY

3870 N. PALMER STREET MILWAUKEE 12, WIS., U. S. A.

MANUFACTURERS AND ENGINEERS—SAND BLAST AND DUST COLLECTING EQUIPMENT—WELDING FUME COLLECTORS

Georgia

Atlanta Area

(Cobb, Fulton Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	675	2
33	Primary Metals	2,135	7
34	Fabricated Metal Products	1,314	14
35	Machinery (Except Electrical)	2,301	19
36	Electrical Machinery & Equipment	270	3
37	Transportation Equipment	3,975	4
38	Instruments & Photographic Equipment	30	1
39	Misc. Mfg. Industries (Metal)	675	2
Atlanta Area Total		11,375	52

Illinois

Chicago Area

(Cook, DuPage, Kane, Lake, Will Counties)

19	Ordnance & Accessories	1,000	1
25	Furniture & Fixtures, Metal	9,497	50
33	Primary Metals	64,747	143
34	Fabricated Metal Products	81,136	533
35	Machinery (Except Electrical)	111,134	438
36	Electrical Machinery & Equipment	105,283	198
37	Transportation Equipment	44,917	88
38	Instruments & Photographic Equipment	14,187	60
39	Misc. Mfg. Industries (Metal)	15,511	89
Chicago Area Total		447,412	1,600

East St. Louis Area

(Madison, St. Clair Counties)

19	Ordnance & Accessories	5,500	1
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	10,092	14
34	Fabricated Metal Products	3,194	19
35	Machinery (Except Electrical)	1,209	7
36	Electrical Machinery & Equipment	..	..
37	Transportation Equipment	800	1
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	30	1
East St. Louis Area Total		20,825	43

enclosed gear drives...

for every industrial need!

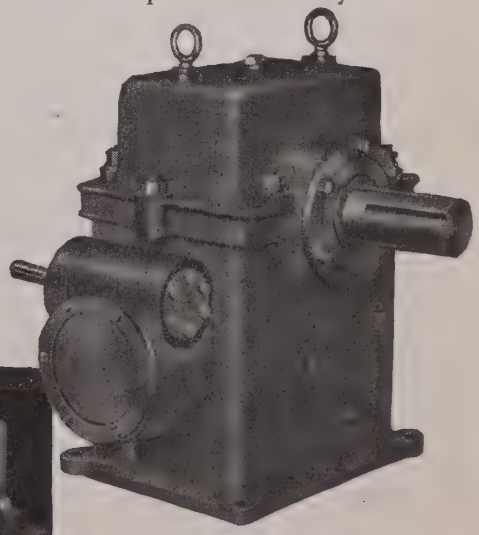
Foote Bros. Hypower Worm Gear Drives, both horizontal and vertical types, offer new economies in space, weight and cost. Increased load-carrying capacity is accomplished by a revolutionary technique in generating gears. The oil bath is cooled by passing a high velocity stream of air through an air channel cylinder immersed in the bath. This provides greatly increased thermal capacity.

Foote Bros. Hygrade Worm Gear Drives are available in a wide variety of types. This line is newly designed and includes sizes and ratios to meet practically any requirement.

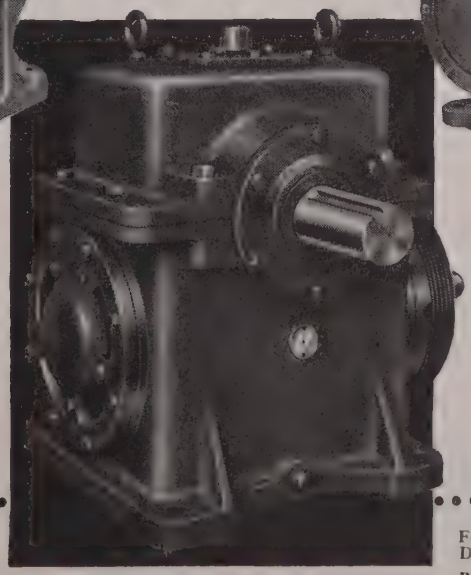
Foote Bros. Maxi-Power Helical Gear Drives are available in single, double and triple reductions. This newly developed line assures maximum performance made possible by the latest in engineering development and by improved methods in manufacture.

Regardless of what your requirements in gears or enclosed gear drives may be, call on Foote Bros. There is a sales office or representative near you.

MAXI-POWER ENCLOSED HELICAL GEAR DRIVES



HYGRADE ENCLOSED WORM GEAR DRIVES



HYPOWER ENCLOSED WORM GEAR DRIVES

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
Dept. M, 4545 South Western Boulevard • Chicago 9 Illinois

Foote Bros. Gear and Machine Corporation
Dept. M, 4545 S. Western Blvd., Chicago 9, Ill.

Please send me bulletins or information on

- ☐ Hypower Enclosed Worm Gear Drives
- ☐ Hygrade Enclosed Worm Gear Drives
- ☐ Maxi-Power Enclosed Helical Gear Drives

Name.....

Company.....

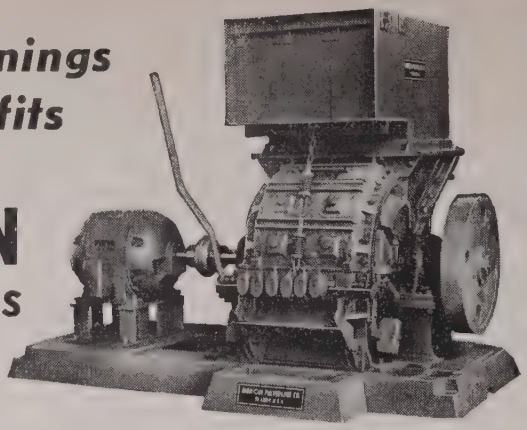
Address.....

City.....*State*.....

Turn Your Turnings Scrap Into Profits

WITH AN

AMERICAN METAL TURNINGS CRUSHER



If you handle over 20 tons of turnings a month, you'll find it highly profitable to install an American Metal Turnings Crusher in your plant. Long, bulky, hard to handle turnings of alloy steel, carbon steel, aluminum, brass, copper or bronze are rapidly reduced to uniform chips, resulting in substantial savings in handling cost, storage space, cutting oil reclamation as well as better briquetting. Capacities to 10 TPH.

Send for metal turnings bulletin

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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ST. LOUIS 10, MO.

BOKUM BORING TOOLS

NOW IN WIDE VARIETY OF SET ASSORTMENTS TO MEET EVERY OPERATOR'S NEED

5 sets Standard
5 sets Extra Long
1 set ½" Shank
1 set ¾" Shank
1 set 1" Shank

Send for catalog showing complete range of sizes and set assortments.

Ask for catalog G.

TRADE MARK REG. U. S. PAT. OFF.

BOKUM TOOL CO.

14775 WILDEMERE AVE. • DETROIT 21, MICH.

SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS

Moline Area

(Henry, Rock Island, Whiteside Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	1,776	1
25	Furniture & Fixtures, Metal	80	1
33	Primary Metals	3,493	12
34	Fabricated Metal Products	4,015	19
35	Machinery (Except Electrical)	23,180	31
36	Electrical Machinery & Equipment	1,005	5
37	Transportation Equipment	295	3
38	Instruments & Photographic Equipment	25	1
39	Misc. Mfg. Industries (Metal)	150	1
Moline Area Total		34,019	74

Peoria Area

(Peoria, Tazewell Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	3,000	9
34	Fabricated Metal Products	1,348	14
35	Machinery (Except Electrical)	21,366	9
36	Electrical Machinery & Equipment	110	3
37	Transportation Equipment	..	..
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
Peoria Area Total		25,824	35

Rockford Area

(Stephenson, Winnebago Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	2,030	10
34	Fabricated Metal Products	9,083	27
35	Machinery (Except Electrical)	11,415	34
36	Electrical Machinery & Equipment	2,000	7
37	Transportation Equipment	2,895	4
38	Instruments & Photographic Equipment	430	1
39	Misc. Mfg. Industries (Metal)	615	5
Rockford Area Total		28,468	88

Special KAYDON Roller Thrust Bearings, 9.437" x 15.125" x 3.500", with split races and split cage

KAYDON *Split* BEARINGS

Easy to put on or take off without dismantling machine

EASY on . . . easy off! These special KAYDON Roller Thrust Bearings have split races and a split cage . . . so you don't have to dismantle the machine to assemble them into position or to remove them from the shaft. There are many applications where this unique type of bearing is a big saver of time and money.

The precision engineering and ingenuity which make these special bearings perform so successfully are major factors in KAYDON procedure to assure dependable quality, rugged strength, and high precision in all KAYDON standard and special bearings . . . from 4" bore to the extremely large KAYDON Bearings, up to 10 feet outside diameter. • In many fields of heavy-duty machinery, KAYDON Bearings help designers add important advantages. Steel mill equipment that operates under terrific loads and high temperatures, mammoth paper mill machinery, huge precision grinders, rugged road-building units, excavators, hoists, crushers, bending machines and other heavy-duty machines, are serving industry better because of KAYDON Bearings.

* * *

Expand your opportunities through use of these modern bearings. Capacity now available for all types and sizes. Contact KAYDON, in confidence!

KAYDON *Types of Standard or Special Bearings:*
Spherical Roller • Taper Roller • Ball Radial
Ball Thrust • Roller Radial • Roller Thrust

THE KAYDON ENGINEERING CORP., MUSKEGON, MICH.

All types of Ball and Roller Bearings 4" bore to 120" outside diameter

Serving a new and growing industry!

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Equipment

Hydraulic Presses
Wax Injectors
Vacuum Pumps
Burn out Ovens
Melting Furnace
Casting Machines

Supplies

Investments
Waxes
Flasks
Crucibles
Tongs
Di Metals

Send for your copy of our booklet "Introduction to Precision Investment Casting" and for our new fully illustrated catalog.

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Successor to J. Goebel & Co.

95 Bedford Street — New York 14, N. Y.

Established 1865

PRECISION CASTING EQUIPMENT & SUPPLIES

WA 4-8880

Springfield Area

(Sangamon, Macon Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	40	1
33	Primary Metals	545	3
34	Fabricated Metal Products	2,230	10
35	Machinery (Except Electrical)	5,475	9
36	Electrical Machinery & Equipment	3,010	4
37	Transportation Equipment	1,075	2
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	205	3
Springfield Area Total		12,580	32

Indiana

Anderson-Muncie Area

(Delaware, Grant, Howard, Madison Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	605	3
33	Primary Metals	4,982	14
34	Fabricated Metal Products	5,638	17
35	Machinery (Except Electrical)	3,091	17
36	Electrical Machinery & Equipment	20,781	9
37	Transportation Equipment	12,409	14
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	863	6
Anderson-Muncie Area Total		48,369	80

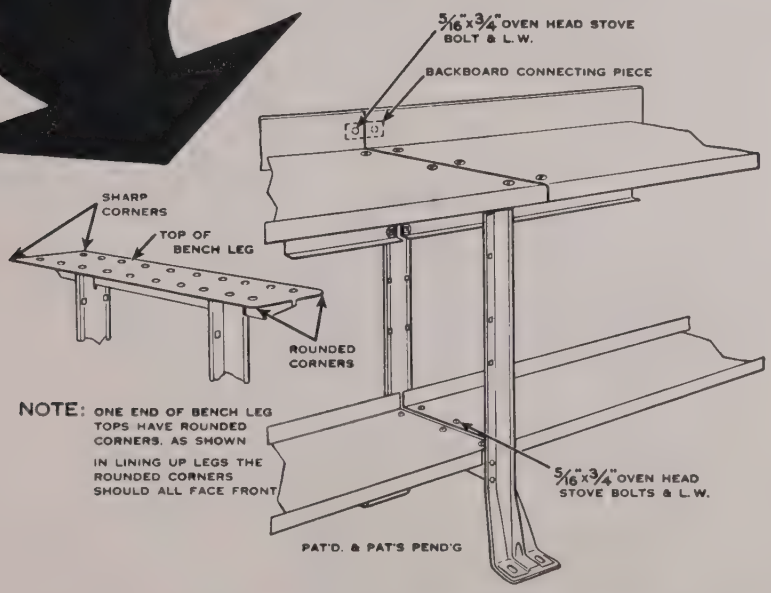
Evansville Area

(Vanderburgh County)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	..	..
34	Fabricated Metal Products	3,175	11
35	Machinery (Except Electrical)	14,089	11
36	Electrical Machinery & Equipment	..	..
37	Transportation Equipment	1,646	2
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
Evansville Area Total		18,910	24

CAN BE BOLTED TOGETHER TO FORM A *continuous* WORK BENCH

Fig. 732
Pat. & Pats. Pending
Drawer is extra.



HALLOWELL

Ready-Made WORK BENCHES OF STEEL

Made in 4 standard heights, 3 widths and 7 lengths, these "Hallowell" units can be used either individually or bolted together to form a continuous work bench—most any length—a money-saving feature *not practicable* with "nailed-together" wooden benches. And these serviceable, ready-made "Hallowell" Work Benches of Steel are ideal equipment for modern shops. "Hallowell" Benches have smooth, long-wearing steel tops, are also available with heavy, high-grade laminated wood tops . . . or steel tops covered with "Tempered Presdwood." The "Hallowell"—rigid as a rock—does *not* require costly bolting to the floor.

Write us for the name and address of your nearest "Hallowell" Industrial Distributor and for your copy of the "Hallowell" Catalog.

OVER 46 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

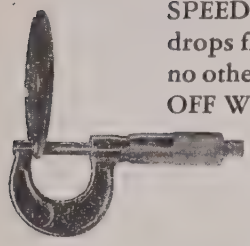
JENKINTOWN, PENNSYLVANIA, BOX 523

BRANCHES: CHICAGO DETROIT ST. LOUIS SAN FRANCISCO

TIME

Electro HIGH SPEED
CUT-OFF WHEELS
Against Anything

Ferrous and non-ferrous metals—even ceramics—give way to the grinding cuts of Electro HIGH SPEED CUT-OFF WHEELS and partition time drops from minutes to *seconds.* No other method, no other tool, equals Electro HIGH SPEED CUT-OFF WHEELS for speed, safety, metal saving.



Send for Grinding Wheel Manual 645 in full color. It's free and completely informing.

Service from Los Angeles or Buffalo

Electro SINCE 1919

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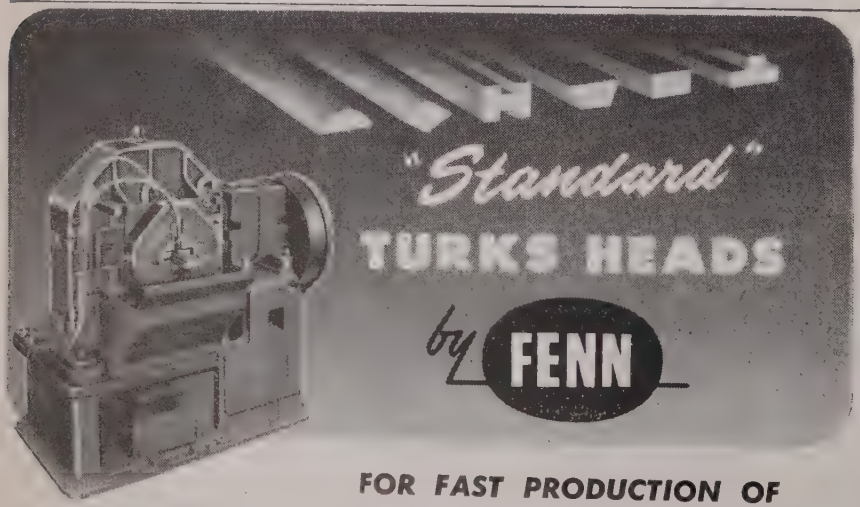
Electro REFRACTORIES & ALLOYS CORPORATION
MFRS. • REFRACTORIES • (High Speed GRINDING WHEELS) • CRUCIBLES • ALLOYS
344 DELAWARE AVENUE BUFFALO 2, NEW YORK



FOR FAST PRODUCTION OF SPECIAL ROLLED SHAPES

"Standard" Turks Heads convert rod stock to plain and ornamental shapes in one speedy operation. These adjustable draw plates are offered in a wide range of capacities, with friction or power driven rolls, in tandem mountings and with special attachments. They hold dimensions within very close tolerances and produce increased tensile strength in the finished shape.

Write for Bulletin TH.

THE FENN MANUFACTURING COMPANY
1848 BROAD ST., P. O. BOX 235, HARTFORD 1, CONN.
Manufacturers of "Standard" Power Presses to 500 Tons • Rolling Mills • Swagers • Turks Heads • Also Fenn Special Machinery

Fort Wayne Area
(Allen County)

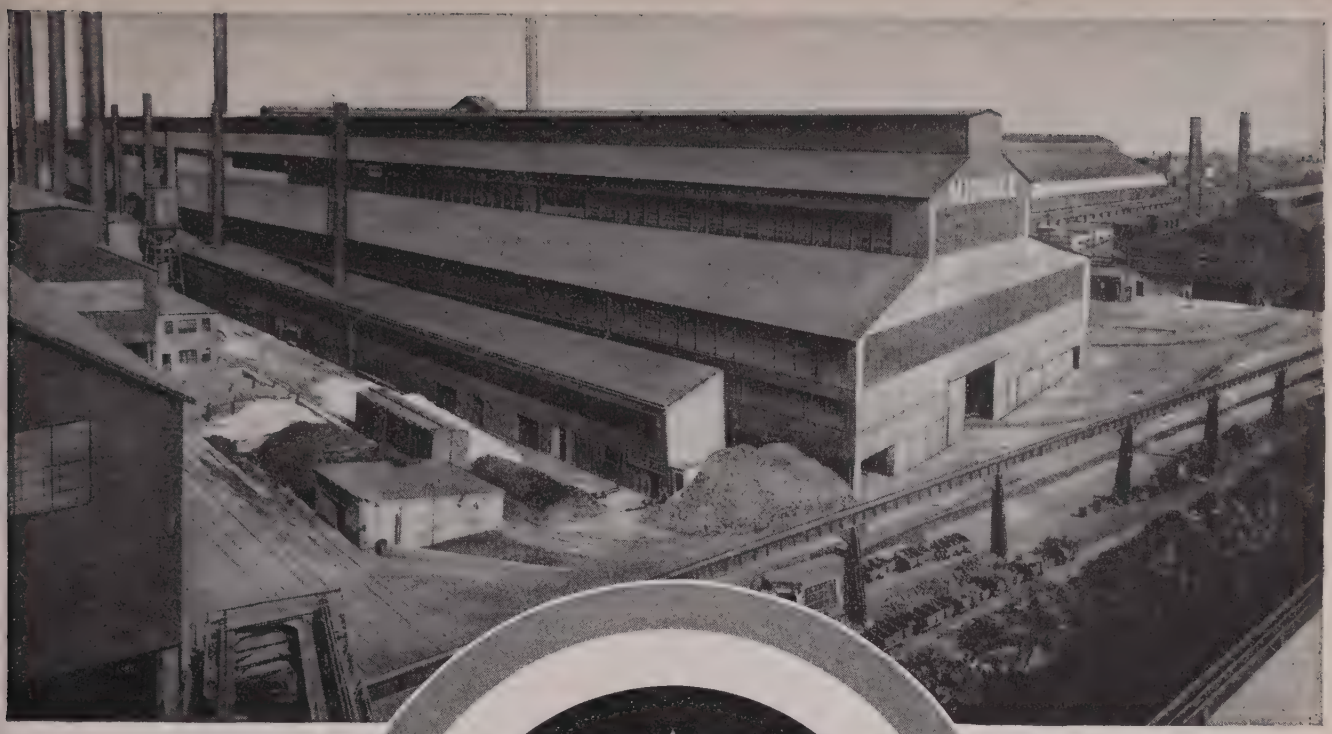
2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	75	1
33	Primary Metals	1,124	5
34	Fabricated Metal Products	718	7
35	Machinery (Except Electrical)	6,222	16
36	Electrical Machinery & Equipment	13,355	9
37	Transportation Equipment	9,280	5
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
Fort Wayne Area Total		30,774	43

Gary Area
(Lake County)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	46,875	16
34	Fabricated Metal Products	4,585	13
35	Machinery (Except Electrical)	2,595	9
36	Electrical Machinery & Equipment	80	1
37	Transportation Equipment	5,475	7
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	400	1
Gary Area Total		60,010	47

Indianapolis Area
(Marion County)

19	Ordnance & Accessories	1,500	1
25	Furniture & Fixtures, Metal	140	3
33	Primary Metals	4,157	16
34	Fabricated Metal Products	6,687	38
35	Machinery (Except Electrical)	11,630	48
36	Electrical Machinery & Equipment	7,213	8
37	Transportation Equipment	11,713	11
38	Instruments & Photographic Equipment	21	1
39	Misc. Mfg. Industries (Metal)	80	2
Indianapolis Area Total		43,141	128



SYMBOL OF THE FINEST

in quality steel making — the Midvale M-Star

For 81 years Midvale has been manufacturing many steel products for a wide range of use. The outstanding performance of these products has earned us an enviable reputation. We look forward to continuing improvement in the manufacture of high quality forgings and high alloy castings to maintain this reputation.

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WELDLESS RINGS—CORROSION AND HEAT RESISTING CASTINGS

THE MIDVALE COMPANY

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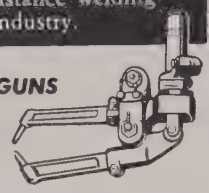
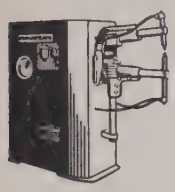
EQUIPMENT *that takes the guesswork out of* RESISTANCE WELDING

Here are seven reasons why Progressive today is the largest supplier of resistance welding equipment to industry.

STANDARDIZED GUNS



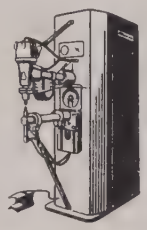
57000 varieties on one chassis alone, through interchangeable jaw extensions and points. **Bulletin No. 402**



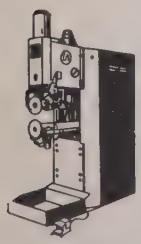
ROCKER ARM WELDERS

For all kinds of light to medium duty jobs. An up-to-the-minute "triple threat": real "beef", real speed, and real adaptability. **Bulletin No. 702**

PEDESTAL SPOT WELDER



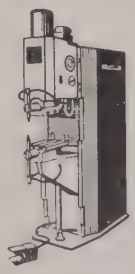
The "universal" spot welder. Built to take it, and how! Quickly adjusted to a variety of jobs. **Bulletin No. 503**



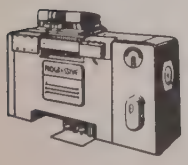
ROLLER HEAD SEAM WELDERS

Another Progressive "first". The roller head follows changes in metal thickness uncannily. You can seam weld faster and better. **Bulletin No. 804**

ROLLER HEAD PRESS WELDERS



For either projection or spot welding. Here, too, the roller head speeds follow-up—gives better welds. Rigid? Take a look at the frame in **Bulletin No. 603**



FLASH WELDERS

Combine the advantages of standard and special machines. More features than you would believe possible on a standard machine. **Bulletin No. 204**

Plus SPECIAL MACHINES

IT PAYS TO WELD

PROGRESSIVE WELDER COMPANY

3050 E. OUTER DRIVE, DETROIT 12, U.S.A

New Castle Area

(Fayette, Henry, Wayne Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,345	2
33	Primary Metals	1,552	6
34	Fabricated Metal Products	2,303	14
35	Machinery (Except Electrical)	7,061	15
36	Electrical Machinery & Equipment	1,100	1
37	Transportation Equipment	7,845	8
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	430	3
New Castle Area Total		22,636	49

South Bend Area

(Elkhart, La Porte, St. Joseph Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	603	5
33	Primary Metals	817	10
34	Fabricated Metal Products	3,512	32
35	Machinery (Except Electrical)	9,821	30
36	Electrical Machinery & Equipment	1,710	5
37	Transportation Equipment	16,205	14
38	Instruments & Photographic Equipment	130	1
39	Misc. Mfg. Industries (Metal)	2,649	11
South Bend Area Total		35,447	108

Kansas

Kansas City Area

(Wyandotte County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	373	2
34	Fabricated Metal Products	1,142	5
35	Machinery (Except Electrical)	154	2
36	Electrical Machinery & Equipment	350	1
37	Transportation Equipment	2,300	2
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
Kansas City Area Total		4,319	12

Wichita Area

(Sedgwick County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	..	..
34	Fabricated Metal Products	1,415	5
35	Machinery (Except Electrical)	1,621	8
36	Electrical Machinery & Equipment	25	1
37	Transportation Equipment	10,295	7
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	36	1
Wichita Area Total		13,392	22

Kentucky

Covington Area

(Campbell, Kenton Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	2,175	2
34	Fabricated Metal Products	622	6
35	Machinery (Except Electrical)	500	5
36	Electrical Machinery & Equipment	530	2
37	Transportation Equipment	60	1
38	Instruments & Photographic Equipment	1,275	2
39	Misc. Mfg. Industries (Metal)	617	5
Covington Area Total		5,779	23

Louisville Area

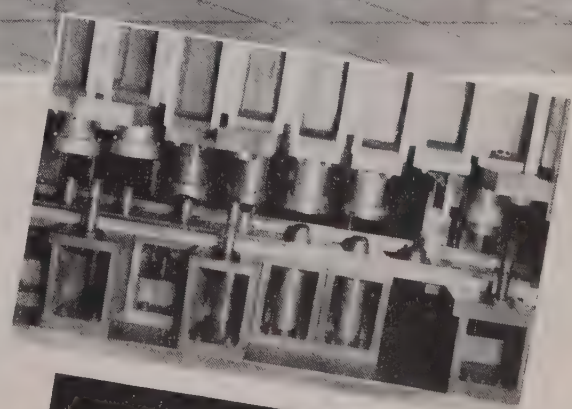
(Jefferson County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	700	1
25	Furniture & Fixtures, Metal	425	2
33	Primary Metals	2,880	6
34	Fabricated Metal Products	9,731	26
35	Machinery (Except Electrical)	7,391	20
36	Electrical Machinery & Equipment	30	1
37	Transportation Equipment	2,165	4
38	Instruments & Photographic Equipment	25	1
39	Misc. Mfg. Industries (Metal)	243	3
Louisville Area Total		23,590	64

Can you match these production figures?

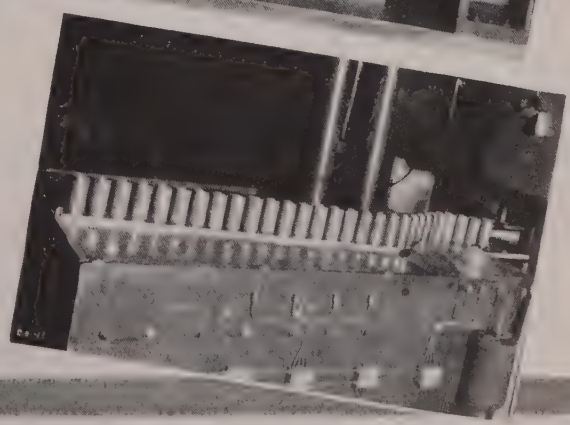
THIS TRADE Verson MARK TRANSMAT PRESS

replaces 7 presses . . . frees 12 men for other jobs . . . automatically produces over 1000 coil containers per hour!



Verson TRANS MAT Presses open a whole new concept of metal forming — completely automatic production. The press illustrated and the accompanying close-ups indicate what can be done. .015″ strip is fed from a coil, blanked and deep drawn into ignition coil containers — 2.1″ in diameter and 4-47/64″ deep. Seven operations are performed without intermediate handling, annealing or pickling. Completed units are discharged at the rate of 1000 per hour.

Consider what this can mean to you in the mass production of your product and write today for additional information.



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No Mobile Crane made today can match **KRANE KAR** speed, safety, and economy of operation... picking up, carrying, and placing loads . . . anywhere, in plant or yard . . . uneven terrain, congested areas, low overhead, up and down ramps.

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KRANE KAR

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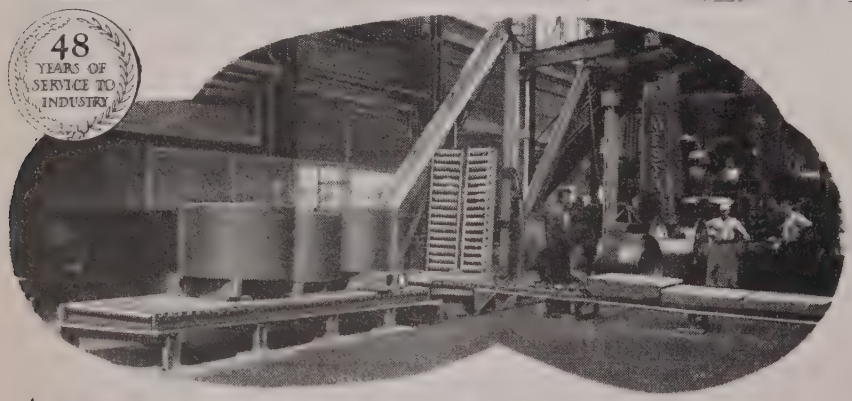

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Offices or Representatives in Principal Cities

Louisiana

New Orleans Area
(Jefferson, Orleans Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	90	1
33	Primary Metals	25	1
34	Fabricated Metal Products	1,764	16
35	Machinery (Except Electrical)	455	5
36	Electrical Machinery & Equipment	140	1
37	Transportation Equipment	4,620	6
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
New Orleans Area Total		**7,094**	**30**

Maryland

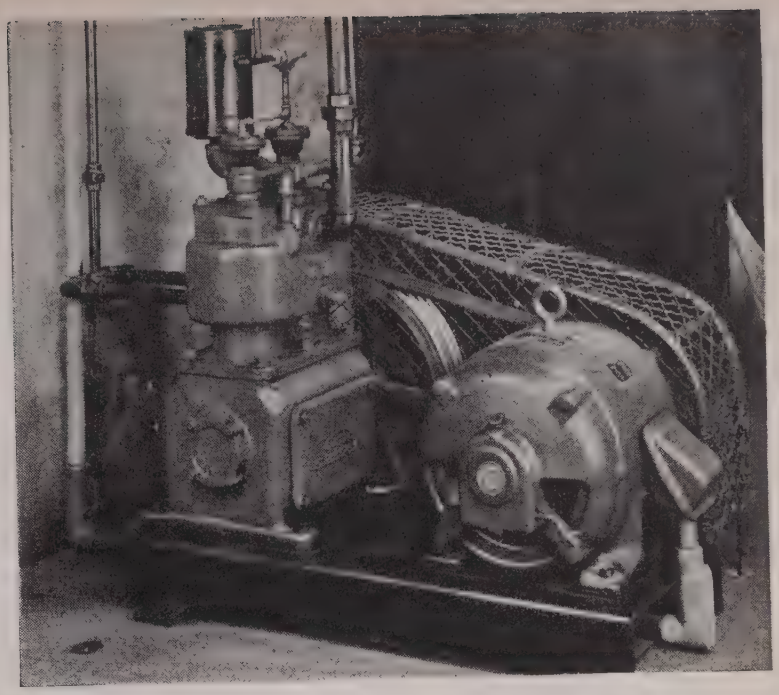
Baltimore Area
(Baltimore County, Baltimore City)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	977	6
33	Primary Metals	24,506	13
34	Fabricated Metal Products	12,299	47
35	Machinery (Except Electrical)	6,891	32
36	Electrical Machinery & Equipment	13,460	13
37	Transportation Equipment	27,312	15
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	1,087	6
Baltimore Area Total		**86,532**	**132**

Hagerstown Area
(Allegany, Frederick, Washington Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	70	1
34	Fabricated Metal Products	415	3
35	Machinery (Except Electrical)	1,983	6
36	Electrical Machinery & Equipment	175	1
37	Transportation Equipment	3,500	1
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	420	1
Hagerstown Area Total		**6,563**	**13**

Curtis Timken Bearing Air Compressor. Sizes from ¼ to 50 H. P., inclusive.



RELIABILITY
That Pays Off in Low-Cost Performance

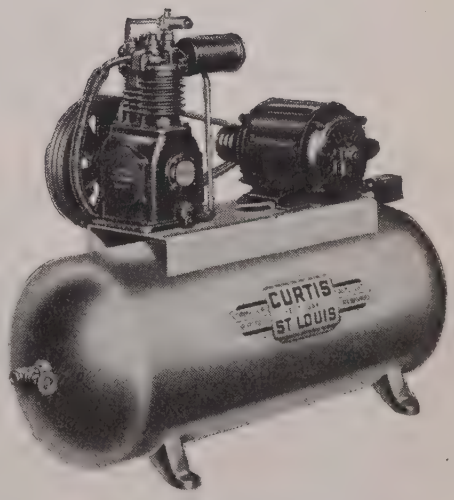
CURTIS TIMKEN BEARING AIR COMPRESSORS

WHATEVER the application, in thousands of varied industrial installations, Curtis Timken Bearing Equipped Air Compressors have a long and proven record of extreme reliability, low maintenance expense and unusually long life.

Every Curtis Air Compressor has been carefully engineered, made of the highest quality materials and precision built throughout.

Their dependable, economical performance is the result of such design advantages as:

- Timken Roller Bearings
- Self-Oiling—Positive Lubrication
- Carbon-Free Disc Valves
- Automatic Pressure Unloader
- Fully Enclosed Design
- Precision Construction



Curtis Timken Bearing Air Compressor with tank. Sizes from ¼ to 10 H.P., inclusive.

Specify CURTIS when you want a reliable, low-cost supply of air for *any* use. Capacities from ¼ to 50 H.P. (up to 300 CFM).

Write today for full information on Curtis Air Compressors, Air Hoists and Air Cylinders—or mail the coupon below.

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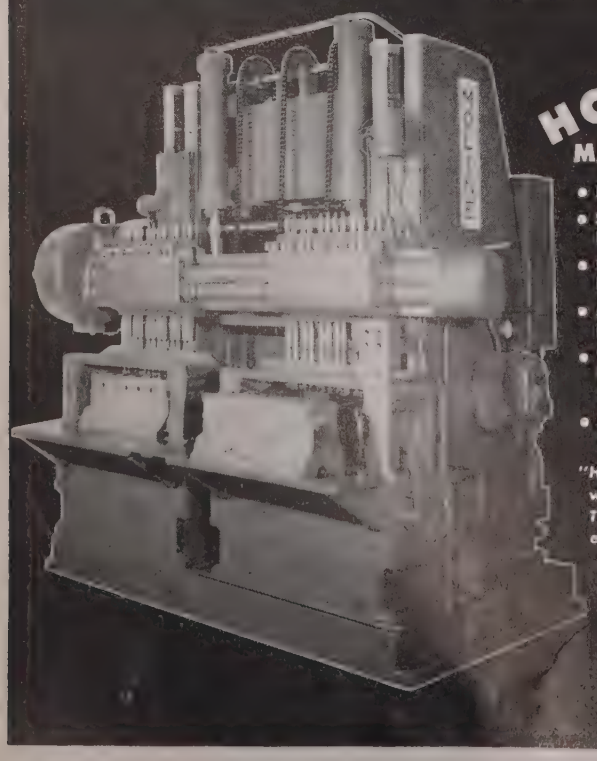

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- Special Multiple Operation Machine Tools

"Hole-Hog" does it better with 50 years of Machine Tool Engineering experience at your service.

MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS

Massachusetts

Boston Area

(Essex, Middlesex, Norfolk, Suffolk Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	2,000	1
25	Furniture & Fixtures, Metal	673	11
33	Primary Metals	2,641	37
34	Fabricated Metal Products	14,308	134
35	Machinery (Except Electrical)	22,043	144
36	Electrical Machinery & Equipment	36,225	44
37	Transportation Equipment	16,691	19
38	Instruments & Photographic Equipment	10,172	32
39	Misc. Mfg. Industries (Metal)	3,851	19
Boston Area Total		108,604	441

Fall River-New Bedford Area

(Bristol County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	60	1
33	Primary Metals	2,007	13
34	Fabricated Metal Products	3,932	20
35	Machinery (Except Electrical)	3,611	22
36	Electrical Machinery & Equipment	3,730	3
37	Transportation Equipment	100	1
38	Instruments & Photographic Equipment	760	5
39	Misc. Mfg. Industries (Metal)	6,590	46
Fall River-New Bedford Area Total		20,790	111

Springfield-Holyoke Area

(Hampden County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	4,001	3
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	4,038	17
34	Fabricated Metal Products	2,892	19
35	Machinery (Except Electrical)	15,382	37
36	Electrical Machinery & Equipment	5,855	6
37	Transportation Equipment	2,280	3
38	Instruments & Photographic Equipment	140	1
39	Misc. Mfg. Industries (Metal)	2,017	7
Springfield-Holyoke Area Total		36,605	93

Tempilstik°

the amazing Crayons that tell temperatures

A simple method of controlling working temperatures in:

- WELDING
- FLAME-CUTTING
- TEMPERING
- FORGING
- CASTING
- MOLDING
- DRAWING
- STRAIGHTENING
- HEAT-TREATING IN GENERAL

It's this simple: Select the Tempilstik° for the working temperature you want. Mark your workpiece with it. When the Tempilstik° mark melts, the specified temperature has been reached.

Also available in pellet or liquid form

Available in these temperatures (°F)

125	275	500	1100
138	288	550	1150
150	300	600	1200
163	313	650	1250
175	325	700	1300
188	338	750	1350
200	350	800	1400
213	363	850	1450
225	375	900	1500
238	388	950	1550
250	400	1000	1600
263	450	1050	

FREE —*Tempil° "Basic Guide to Ferrous Metallurgy"* — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

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Worcester Area
(Worcester County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	690	2
25	Furniture & Fixtures, Metal	1,570	3
33	Primary Metals	7,877	21
34	Fabricated Metal Products	11,191	56
35	Machinery (Except Electrical)	25,408	66
36	Electrical Machinery & Equipment	185	3
37	Transportation Equipment	1,517	3
38	Instruments & Photographic Equipment	4,330	4
39	Misc. Mfg. Industries (Metal)	2,080	13
Worcester Area Total		54,848	171

Michigan

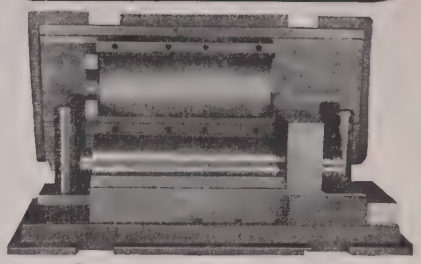
Detroit Area
(Macomb, Oakland, Washtenaw, Wayne Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	889	7
33	Primary Metals	33,494	107
34	Fabricated Metal Products	46,241	275
35	Machinery (Except Electrical)	56,491	337
36	Electrical Machinery & Equipment	6,899	35
37	Transportation Equipment	248,289	105
38	Instruments & Photographic Equipment	2,831	12
39	Misc. Mfg. Industries (Metal)	2,841	24
Detroit Area Total		397,975	902

Flint Area
(Bay, Genesee, Saginaw, Shiawassee Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	265	2
33	Primary Metals	6,899	10
34	Fabricated Metal Products	1,601	16
35	Machinery (Except Electrical)	6,697	28
36	Electrical Machinery & Equipment	3,780	4
37	Transportation Equipment (Inplete)	13,670	14
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	300	5
(Incomplete Flint Area Total		33,212	79

Made of HOLLIDAY SPEED CASE and SPEED TREAT Plates



total die cost reduced.. 23%

The use of *Speed Case* and *Speed Treat* Plates in making this 20" x 45" punch and die for forming No. 12 gauge 8" diameter furnace pipe provided an overall cost saving of 23% to Beach Specialty Co., St. Clair Shores, Michigan. Machining time was sharply reduced compared with other steels. Both punch and die were hardened in water.

You, too, can profit substantially through the incomparable machinability and ready responsiveness to heat treatment of *Speed Case* and *Speed Treat* steels. Ask our nearest representative for full information.

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HOUSTON 1, Texas
Earle M. Jorgensen Co.
LOS ANGELES 54, California
Earle M. Jorgensen Co.
MEMPHIS 2, Tennessee
Pidgeon-Thomas Iron Company
NEWARK 5, New Jersey
Grammer, Dempsey & Hudson, Inc.
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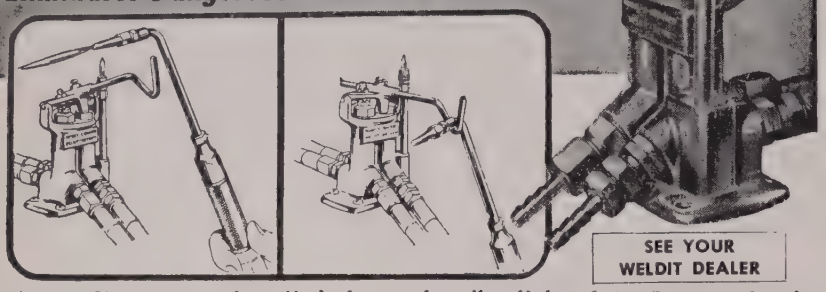

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When the torch is again picked up for further welding operations, the operator passes it across the pilot light of the Gasaver, thereby instantly igniting the torch at the pre-adjusted flame, ready for work — no adjustments to make.

Gasaver can be installed any convenient place on the line between regulators and torch. Most of America's largest production plants are now Gasaver equipped.

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Weldit INC. SINCE 1918

Some distributor territory still available.

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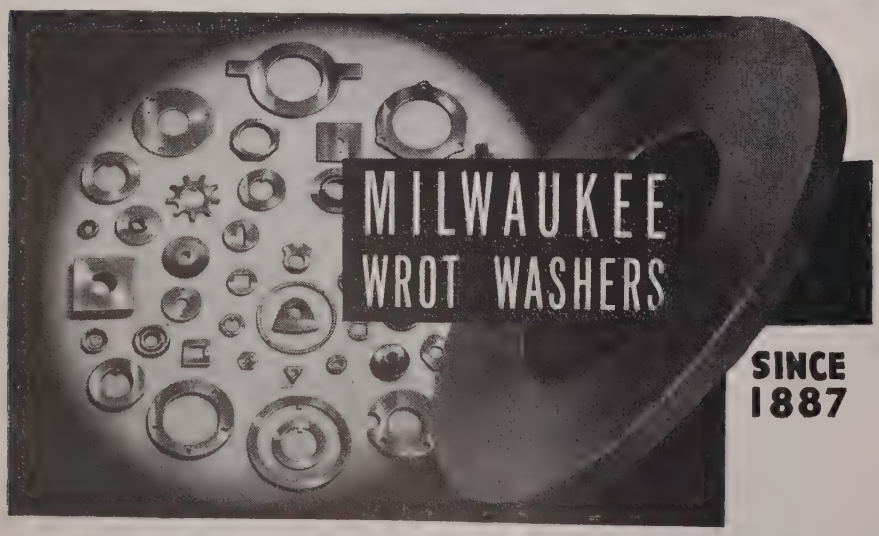

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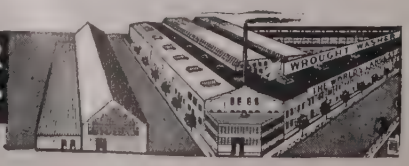

Grand Rapids Area
(Kent, Muskegon, Ottawa Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	6,025	13
33	Primary Metals	7,818	17
34	Fabricated Metal Products	12,295	53
35	Machinery (Except Electrical)	17,987	50
36	Electrical Machinery & Equipment	1,654	5
37	Transportation Equipment	15,765	20
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	2,730	8
Grand Rapids Area Total		64,274	166

Lansing Area
(Calhoun, Ingham, Jackson, Kalamazoo Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	1,175	3
33	Primary Metals	3,342	19
34	Fabricated Metal Products	7,984	35
35	Machinery (Except Electrical)	9,750	48
36	Electrical Machinery & Equipment	1,400	5
37	Transportation Equipment	20,065	23
38	Instruments & Photographic Equipment	100	1
39	Misc. Mfg. Industries (Metal)	1,595	6
Lansing Area Total		45,411	140

Minnesota

Minneapolis-St. Paul Area
(Dakota, Hennepin, Ramsey Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	300	1
33	Primary Metals	1,349	18
34	Fabricated Metal Products	6,239	47
35	Machinery (Except Electrical)	15,871	71
36	Electrical Machinery & Equipment	6,965	18
37	Transportation Equipment	2,254	6
38	Instruments & Photographic Equipment	5,480	3
39	Misc. Mfg. Industries (Metal)	438	10
Minneapolis-St. Paul Area Total		38,896	174

Balance of Minnesota

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	4,066	13
34	Fabricated Metal Products	2,123	13
35	Machinery (Except Electrical)	3,377	29
36	Electrical Machinery & Equipment	1,800	4
37	Transportation Equipment	795	6
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	37	1
Other Area Total		**12,198**	**66**

Missouri

Kansas City Area
(Clay, Jackson Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	240	4
33	Primary Metals	3,185	6
34	Fabricated Metal Products	4,114	24
35	Machinery (Except Electrical)	3,617	19
36	Electrical Machinery & Equipment	790	8
37	Transportation Equipment	3,110	6
38	Instruments & Photographic Equipment	75	2
39	Misc. Mfg. Industries (Metal)	265	4
Kansas City Area Total		**15,396**	**73**

St. Louis Area
(St. Louis County, St. Louis City)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,540	13
33	Primary Metals	4,347	20
34	Fabricated Metal Products	13,623	93
35	Machinery (Except Electrical)	10,734	66
36	Electrical Machinery & Equipment	20,645	27
37	Transportation Equipment	16,354	14
38	Instruments & Photographic Euipment	1,171	3
39	Misc. Mfg. Industries (Metal)	1,707	16
St. Louis Area Total		**71,121**	**252**

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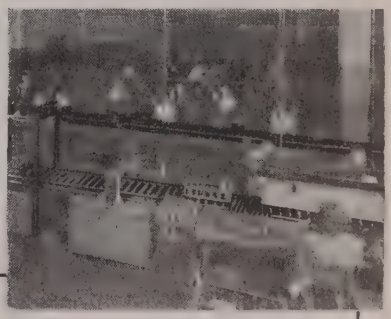

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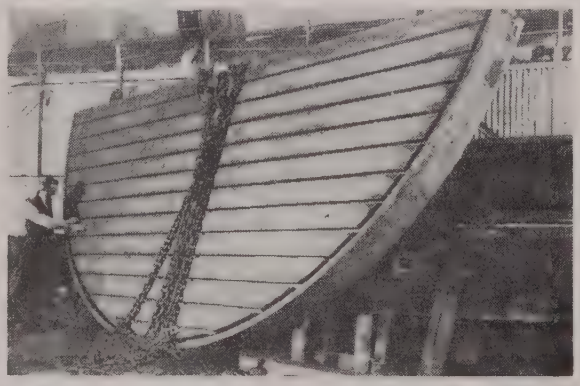

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THE ADVANCE FOUNDRY CO.

DAYTON 3, OHIO

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STRENES METAL • ALLOY GRAY IRON • GRAY IRON

New Jersey

Camden Area

(Burlington, Camden, Gloucester Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	3,588	9
34	Fabricated Metal Products	1,359	12
35	Machinery (Except Electrical)	1,946	16
36	Electrical Machinery & Equipment	16,851	5
37	Transportation Equipment	4,500	4
38	Instruments & Photographic Equipment	575	2
39	Misc. Mfg. Industries (Metal)	823	1
Camden Area Total		29,642	51

Newark-Jersey City Area

(Bergen, Essex, Hudson, Middlesex, Passaic, Union Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	750	1
25	Furniture & Fixtures, Metal	3,420	10
33	Primary Metals	22,488	86
34	Fabricated Metal Products	28,399	216
35	Machinery (Except Electrical)	45,131	216
36	Electrical Machinery & Equipment	69,235	105
37	Transportation Equipment	40,791	36
38	Instruments & Photographic Equipment	5,661	26
39	Misc. Mfg. Industries (Metal)	14,263	68
Newark—Jersey City Area—Total		230,138	764

Trenton Area

(Mercer County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	30	1
33	Primary Metals	6,296	6
34	Fabricated Metal Products	5,610	13
35	Machinery (Except Electrical)	4,035	11
36	Electrical Machinery & Equipment	3,225	9
37	Transportation Equipment	45	1
38	Instruments & Photographic Equipment	300	2
39	Misc. Mfg. Industries (Metal)	195	2
Trenton Area Total		19,736	45

New York

Albany-Schenectady-Troy Area

(Albany, Rensselaer, Schenectady Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	2,000	1
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	1,080	7
34	Fabricated Metal Products	432	6
35	Machinery (Except Electrical)	1,989	9
36	Electrical Machinery & Equipment	15,482	4
37	Transportation Equipment	7,000	2
38	Instruments & Photographic Equipment	655	3
39	Misc. Mfg. Industries (Metal)	80	1
	Albany-Schenectady-Troy Area—Total	**28,718**	**33**

Binghamton-Elmira Area

(Broome, Chemung, Tioga Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	1,770	6
34	Fabricated Metal Products	1,385	7
35	Machinery (Except Electrical)	16,808	12
36	Electrical Machinery & Equipment	1,800	1
37	Transportation Equipment	1,169	4
38	Instruments & Photographic Equipment	1,515	3
39	Misc. Mfg. Industries (Metal)	..	..
	Binghamton-Elmira Area—Total	**24,447**	**33**

Buffalo Area

(Erie, Niagara Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	442	4
33	Primary Metals	31,843	53
34	Fabricated Metal Products	11,914	61
35	Machinery (Except Electrical)	9,847	56
36	Electrical Machinery & Equipment	16,665	12
37	Transportation Equipment	24,534	17
38	Instruments & Photographic Equipment	1,824	6
39	Misc. Mfg. Industries (Metal)	437	9
	Buffalo Area Total	**97,506**	**218**

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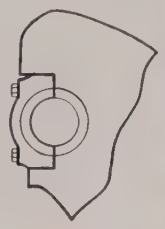

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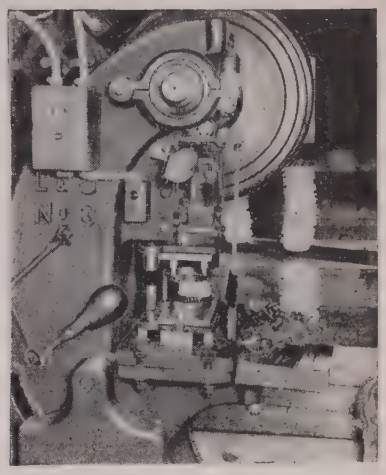

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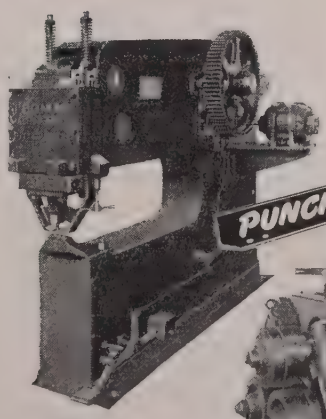

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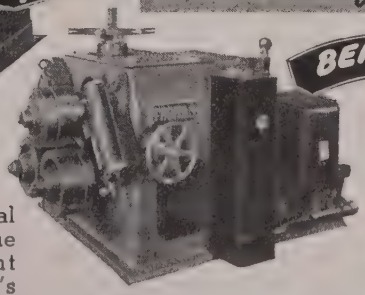

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New York City Area

(Bronx, Kings, Nassau, New York, Queens, Richmond, Westchester Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	105	2
25	Furniture & Fixtures, Metal	5,022	44
33	Primary Metals	7,481	57
34	Fabricated Metal Products	31,006	358
35	Machinery (Except Electrical)	23,453	176
36	Electrical Machinery & Equipment	35,889	142
37	Transportation Equipment	39,902	48
38	Instruments & Photographic Equipment	15,653	61
39	Misc. Mfg. Industries (Metal)	12,534	107
	New York City Area Total	**171,045**	**995**

Rochester Area

(Monroe County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	595	2
25	Furniture & Fixtures, Metal	657	3
33	Primary Metals	1,143	8
34	Fabricated Metal Products	2,558	20
35	Machinery (Except Electrical)	9,386	42
36	Electrical Machinery & Equipment	9,093	8
37	Transportation Equipment	3,395	2
38	Instruments & Photographic Equipment	41,483	16
39	Misc. Mfg. Industries (Metal)	2,310	5
	Rochester Area Total	**70,620**	**106**

Syracuse Area

(Cayuga, Onondaga, Oswego Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	300	1
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	5,196	16
34	Fabricated Metal Products	3,971	28
35	Machinery (Except Electrical)	16,547	35
36	Electrical Machinery & Equipment	2,607	5
37	Transportation Equipment	4,772	7
38	Instruments & Photographic Equipment	40	1
39	Misc. Mfg. Industries (Metal)	286	3
	Syracuse Area Total	**33,719**	**96**

Ohio

Akron Area

(Summit County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	1,060	9
34	Fabricated Metal Products	5,925	23
35	Machinery (Except Electrical)	3,867	27
36	Electrical Machinery & Equipment	1,029	5
37	Transportation Equipment	3,400	2
38	Instruments & Photographic Equipment	40	1
39	Misc. Mfg. Industries (Metal)	255	2
	Akron Area Total	**15,576**	**69**

Canton Area

(Stark, Tuscarawas Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,270	5
33	Primary Metals	11,044	22
34	Fabricated Metal Products	9,635	27
35	Machinery (Except Electrical)	12,202	27
36	Electrical Machinery & Equipment	1,771	7
37	Transportation Equipment	46	1
38	Instruments & Photographic Equipment	300	1
39	Misc. Mfg. Industries (Metal)	51	1
	Canton Area Total	**37,319**	**91**

Cincinnati Area

(Butler, Hamilton Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,780	7
33	Primary Metals	9,762	33
34	Fabricated Metal Products	11,948	71
35	Machinery (Except Electrical)	25,847	103
36	Electrical Machinery & Equipment	5,722	19
37	Transportation Equipment	7,695	13
38	Instruments & Photographic Equipment	576	5
39	Misc. Mfg. Industries (Metal)	3,548	16
	Cincinnati Area Total	**67,878**	**267**

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Cleveland Area
(Cuyahoga, Lorain Counties)

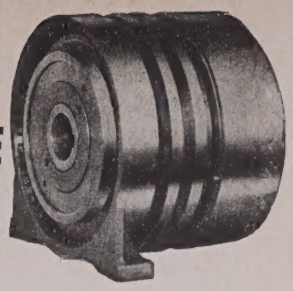
2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	917	6
33	Primary Metals	51,331	97
34	Fabricated Metal Products	41,485	243
35	Machinery (Except Electrical)	50,028	200
36	Electrical Machinery & Equipment	21,809	52
37	Transportation Equipment	32,606	39
38	Instruments & Photographic Equipment	2,211	11
39	Misc. Mfg. Industries (Metal)	2,087	14
Cleveland Area Total		202,474	662

Columbus Area
(Franklin County)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	2,718	9
34	Fabricated Metal Products	7,581	29
35	Machinery (Except Electrical)	9,564	30
36	Electrical Machinery & Equipment	750	3
37	Transportation Equipment	5,300	9
38	Instruments & Photographic Equipment	85	2
39	Misc. Mfg. Industries (Metal)	1,360	4
Columbus Area Total		27,358	86

Dayton Area
(Clark, Greene, Miami, Montgomery Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	633	3
33	Primary Metals	4,279	26
34	Fabricated Metal Products	2,680	32
35	Machinery (Except (Electrical)	48,692	91
36	Electrical Machinery & Equipment	14,975	10
37	Transportation Equipment	15,712	22
38	Instruments & Photographic Equipment	425	3
39	Misc. Mfg. Industries (Metal)	827	8
Dayton Area Total		88,223	195



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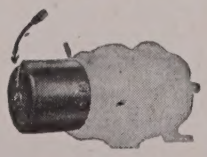

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PULLEYS - DRUMS - CLUTCHES

• • This listing of areas covers only the major industrial areas. Complete data on all U. S. industrial areas, with more detailed breakdown on plant size based on number of workers, and also data on types of departments operated are available from the Research Dept., THE IRON AGE, *100 E. 42nd St., New York 17.*

Toledo Area
(Lucas County)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	151	3
33	Primary Metals	5,109	15
34	Fabricated Metal Products	4,891	35
35	Machinery (Except Electrical)	11,660	37
36	Electrical Machinery & Equipment	10,217	9
37	Transportation Equipment	16,755	13
38	Instruments & Photographic Equipment	274	2
39	Misc. Mfg. Industries (Metal)	78	3
Toledo Area Total		**49,135**	**117**

Youngstown Area
(Mahoning, Trumbull)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,852	2
33	Primary Metals	38,841	16
34	Fabricated Metal Products	9,393	33
35	Machinery (Except Electrical)	3,601	17
36	Electrical Machinery & Equipment	6,545	8
37	Transportation Equipment	2,285	6
38	Instruments & Photographic Equipment	35	1
39	Misc. Mfg. Industries (Metal)	200	1
Youngstown Area Total		**63,752**	**84**

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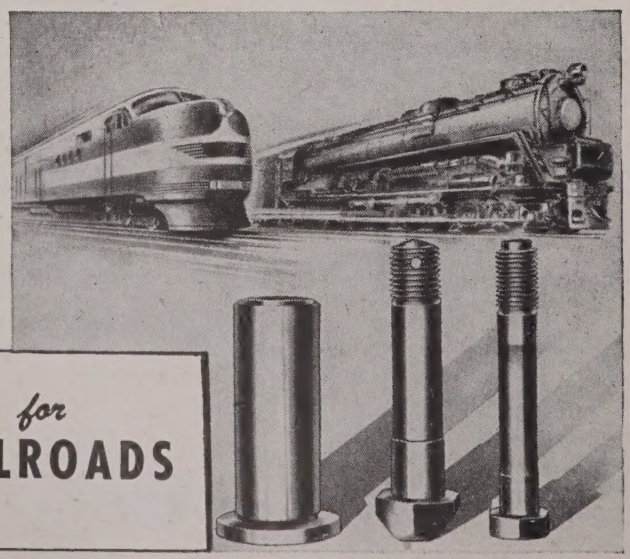

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Pennsylvania

Allentown-Bethlehem Area
(Lehigh, Northampton Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	2,852	2
33	Primary Metals	16,052	7
34	Fabricated Metal Products	3,585	21
35	Machinery (Except Electrical)	3,971	18
36	Electrical Machinery & Equipment	1,001	5
37	Transportation Equipment	..	..
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	325	2
Allentown-Bethlehem Area—Total		**24,934**	**53**

Erie Area
(Crawford, Erie, Venango Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	625	2
33	Primary Metals	3,693	15
34	Fabricated Metal Products	6,577	35
35	Machinery (Except Electrical)	8,223	32
36	Electrical Machinery & Equipment	2,276	8
37	Transportation Equipment	18,660	2
38	Instruments & Photographic Equipment	2,098	5
39	Misc. Mfg. Industries (Metal)	4,000	3
Erie Area Total		**46,152**	**102**

Lancaster-York Area
(Dauphin, Lancaster, Lebanon, York Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	1,300	1
25	Furniture & Fixtures, Metal	35	1
33	Primary Metals	14,593	24
34	Fabricated Metal Products	8,777	45
35	Machinery (Except Electrical)	9,938	42
36	Electrical Machinery & Equipment	2,301	5
37	Transportation Equipment	1,231	7
38	Instruments & Photographic Equipment	3,000	1
39	Misc. Mfg. Industries (Metal)	542	3
Lancaster-York Area Total		**41,717**	**129**

Philadelphia Area

Bucks, Chester, Delaware, Montgomery, Philadelphia Counties)

Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	2,000	1
25	Furniture & Fixtures, Metal	2,091	21
33	Primary Metals	21,514	74
34	Fabricated Metal Products	39,815	198
35	Machinery (Except Electrical)	38,032	170
36	Electrical Machinery & Equipment	22,773	41
37	Transportation Equipment	34,105	27
38	Instruments & Photographic Equipment	5,130	29
39	Misc. Mfg. Industries (Metal)	3,096	34
hiladelphia Area Total		**168,556**	**595**

Pittsburgh Area

(Allegheny, Beaver, Washington, Westmoreland Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	170	3
33	Primary Metals	137,892	115
34	Fabricated Metal Products	31,567	114
35	Machinery (Except Electrical)	19,988	74
36	Electrical Machinery & Equipment	33,148	24
37	Transportation Equipment	13,543	14
38	Instruments & Photographic Equipment	2,749	9
39	Misc. Mfg. Industries (Metal)	2,396	11
Pittsburgh Area Total		**241,453**	**364**

Reading Area

(Berks County)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	4,441	19
34	Fabricated Metal Products	3,108	21
35	Machinery (Except Electrical)	7,597	16
36	Electrical Machinery & Equipment	..	..
37	Transportation Equipment	2,030	4
38	Instruments & Photographic Equipment	500	1
39	Misc. Mfg. Industries (Metal)	650	4
Reading Area Total		**18,326**	**65**

Sharon-Newcastle Area

(Lawrence, Mercer Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	12,489	13
34	Fabricated Metal Products	2,853	15
35	Machinery (Except Electrical)	7,380	10
36	Electrical Machinery & Equipment	7,165	2
37	Transportation Equipment	2,450	2
38	Instruments & Photographic Equipment	..	..
39	Misc. Mfg. Industries (Metal)	..	..
Sharon-Newcastle Area Total		**32,337**	**42**

Texas

Dallas-Fort Worth Area

(Dallas, Tarrant Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	166	4
33	Primary Metals	820	6
34	Fabricated Metal Products	3,169	26
35	Machinery (Except Electrical)	3,475	32
36	Electrical Machinery & Equipment	156	3
37	Transportation Equipment	13,021	5
38	Instruments & Photographic Equipment	70	1
39	Misc. Mfg. Industries (Metal)	..	..
Dallas-Fort Worth Area Total		**20,877**	**77**

Houston Area

(Galveston, Harris Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	60	1
33	Primary Metals	4,025	12
34	Fabricated Metal Products	4,580	32
35	Machinery (Except Electrical)	9,377	36
36	Electrical Machinery & Equipment	..	..
37	Transportation Equipment	2,550	4
38	Instruments & Photographic Equipment	42	2
39	Misc. Mfg. Industries (Metal)	..	..
Houston Area Total		**20,634**	**87**

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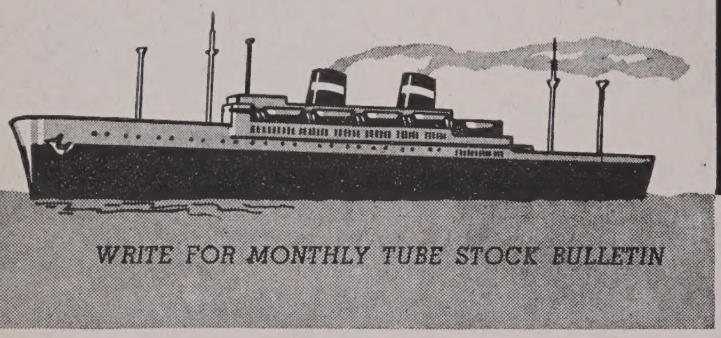

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Washington

Seattle Area

(King, Kitsap, Pierce, Snohomish Counties)

2-Digit Govt. Code	Titles of 2-Digit Groups	Workers in plants with over 21 workers	No. of plants over 21 workers
19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	128	1
33	Primary Metals	2,314	13
34	Fabricated Metal Products	3,115	36
35	Machinery (Except Electrical)	3,485	29
36	Electrical Machinery & Equipment	402	4
37	Transportation Equipment	23,894	17
38	Instruments & Photographic Equipment	25	1
39	Misc. Mfg. Industries (Metal)	75	1
Seattle Area Total		**33,438**	**102**

Wisconsin

Madison Area

(Dane, Rock Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	..	..
33	Primary Metals	400	4
34	Fabricated Metal Products	125	3
35	Machinery (Except Electrical)	9,141	17
36	Electrical Machinery & Equipment	878	3
37	Transportation Equipment	1,625	4
38	Instruments & Photographic Equipment	540	2
39	Misc. Mfg. Industries (Metal)	..	..
Madison Area Total		**12,709**	**33**

Milwaukee Area

(Kenosha, Milwaukee, Racine Counties)

19	Ordnance & Accessories	..	..
25	Furniture & Fixtures, Metal	3,760	5
33	Primary Metals	13,716	49
34	Fabricated Metal Products	14,205	101
35	Machinery (Except Electrical)	50,710	131
36	Electrical Machinery & Equipment	24,820	33
37	Transportation Equipment	28,787	22
38	Instruments & Photographic Equipment	1,186	6
39	Misc. Mfg. Industries (Metal)	1,059	9
Milwaukee Area Total		**138,243**	**356**